

ABSTRACT

Title: of Dissertation: WHAT'S CULTURE GOT TO DO WITH IT?
AN INVESTIGATION INTO THE INDIVIDUAL AND
INSTITUTIONAL FACTORS THAT SUPPORT
UNDERREPRESENTED MINORITY AND FIRST-
GENERATION WOMEN GRADUATE STUDENTS'
SUCCESS IN STEM FIELDS

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This qualitative research study applies feminist standpoint theory and community cultural wealth to investigate the individual and institutional factors that underrepresented minority and first-generation women graduate students report as having contributed to their gaining access to and navigating through their graduate STEM degree programs. Through the presentation of five women graduate students' *testimonios*, this study offers the women participants an opportunity to provide a counternarrative in their own voices to the prevailing deficit lens with which education literature views them.

This study highlights the ways in which the assets from the women's community cultural wealth, although overlooked by their graduate institution, are instrumental to their

success. In addition, this study asks the women participants to share their perceptions of the institutional resources and services available to them and evaluate their utility in supporting them. The women's narratives are *testimonios* to their experiences as underrepresented minority and first-generation women graduate students in STEM fields.

The findings both provide a counternarrative to the deficit literature on underrepresented minority and first-generation women students in STEM fields and add to the literature that uses Yosso's (2005) community cultural wealth as a conceptual framework by expanding its application to other underrepresented populations in the United States and to advanced, highly technical STEM fields. Additionally, the findings have implications for educational practice and further research: they suggest that universities need to better understand the multiple aspects of students' individual cultures and reconfigure their campus and STEM classroom cultures in ways that are structured by and reflective of students' community cultural wealth

keywords: underrepresented minorities, gender, first-generation graduate students, community cultural wealth, STEM

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THAT SUPPORT UNDERREPRESENTED MINORITY AND FIRST-GENERATION
WOMEN GRADUATE STUDENTS' SUCCESS IN STEM FIELDS

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DEDICATION

To my Dad: Thank you for raising me to have dreams, encouraging me to pursue them, and helping me to achieve them. May you rest in peace always.

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To my parents: I will never have the right words to express my gratitude to you for all of the support that you have always so generously offered and continue to give me. Thank you for providing me with a strong foundation for my education and life. I recognize and appreciate all of the sacrifices that you made for me to achieve my goals. I know that I could not have done any of this without you.

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CHAPTER ONE: INTRODUCTION

“Every girl deserves to take part in creating the technology that will change our world and change who runs it.” – Malala Yousefzai

“In the future, there will be no female leaders. There will just be leaders.” - Sheryl Sandberg (2013, p. 172).

When I read these two statements, as a self-proclaimed feminist, my initial response is one of total agreement and support. However, when I take a second look at these messages through my academic lens, I notice multiple distinctions between the two. The first statement suggests that each and every individual girl deserves the opportunity to be involved in all stages of the process of developing important technology, which includes the education and training for technology, the design and development of technology, as well as the marketing and use of it. In addition, the quote also indicates that the resulting technological products will have the potential to alter the current state of affairs in the world as well as the people who govern and lead it.

The second quote, which also encourages female leadership, suggests that at some point in the undisclosed future, the need to distinguish female leaders from male leaders will disappear because equality between women and men at the leadership level will be achieved. It also presumes that no differentiation exists or is needed between men and women nor among women themselves. In applying this quote to women's advancement in technology, the steps for achieving this vision appear even more unclear. I am left pondering: when in the future will this equality be achieved? What actions and perspectives will enable as many women as men to hold leadership positions? Will all women need the

same amount and types of support throughout this process? In what ways can or should this support be differentiated?

Although both Yousefzai and Sandberg clearly advocate for gender equality, the quotes allude to different paths for achieving it. In discussing education policies and practices to increase and diversify the number of women who enroll in and complete STEM (science, technology, engineering, and mathematics) degrees in the United States, similarly divergent arguments exist. Proponents of logic similar to Sandberg's contend that all students have an equal opportunity to succeed and that they are solely responsible for their own success. Furthermore, these misguided arguments uncritically suggest that distinctions among gender, race/ethnicity, and class no longer exist because merit alone determines any and all of the differences among students' educational outcomes (McNamee & Miller, 2004). In STEM fields, perceptions about the existence of a "null educational environment" further exacerbate what McNamee and Miller (2004) call the "myth of meritocracy" by suggesting that the perceived neutrality, rationality, and objectivity of these technical fields facilitate both equal opportunities and outcomes for all students (Freeman, 1979).

In addition, many justifications for an increased focus on STEM education center on the individual and societal economic benefits (Carnevale, Smith, & Melton 2011; Carnevale, Smith & Strohl, 2012). Arguments for diversifying STEM fields and occupations have an economic component: a more diverse workforce is more representative of the population and thus better able to meet the demands of the population through innovation and entrepreneurship (Dychtwald, 2010; Museus, Palmer, Davis, & Maramba 2011). For example, Museus et al. (2011) suggest that this diversification is especially important for STEM fields: they indicate that "increased access among racial

and ethnic minority students in STEM is associated with maintaining America's competitiveness in the global marketplace" (p. 4).

However, policymakers and practitioners who apply a logic similar to Yousefzai argue that increasing and diversifying the number of STEM students and degree holders is not only an economic imperative, but, more importantly, a social justice issue because gender, racial/ethnic, and economic disparities exist among students who enroll in STEM programs and attain degrees (Beede, Julian, McKittrick, Khan, & Doms, 2011; Museus et al., 2011). Carnevale et al. (2011) contend that diversity has both instrumental and intrinsic value: it can contribute to economic growth and development but is also a laudable goal itself. Ong, Wright, Espinosa, and Orfield (2011) further develop this argument in suggesting specific economic (e.g., health and technological innovations) and social justice (e.g., remedying historical practices of oppression and exclusion) implications that would result from addressing the existing racial and gender inequities in STEM fields.

In applying a social justice vision, which involves the participation of "*every girl*," this qualitative study investigates the questions: what individual and institutional factors support the women least likely to participate in and successfully complete the most advanced STEM degrees? To answer that question, this study begins by reviewing the literature that shows who the least likely students are to participate in or graduate with STEM degrees. Women participate in and graduate from STEM degree programs at a consistently lower rate than men, and this gender difference in degree completion is especially significant at the graduate level (Hill, Corbett, & St. Rose, 2010). In addition, the National Action Council for Minorities in Engineering (NACME) reports that African Americans, Latinas/os, and American Indian/Alaska Native students are significantly

underrepresented in STEM graduate programs (NACME, 2013). Estrada et al. (2016) contend that the extent of this underrepresentation increases with each subsequent degree level: the ratio between the number of underrepresented minority students' STEM degree completions and white students' STEM degree completions widen at the master's level and again at the doctoral level. Statistics from Redford and Hoyer's (2017) report, *First-Generation and Continuing-Generation College Students: A Comparison of High School and Post-Secondary Experiences*, highlight that "a lower percentage of first-generation college students than continuing-generation students were White (49 vs. 70 percent). However, among Black and Hispanic students, the pattern was reversed" (p. 6). In other words, a larger percentage of underrepresented minority students, specifically from African American (14 vs. 11 percent) and Hispanic (27 vs. 9 percent) backgrounds, are first-generation college students (Redford & Hoyer, 2017, p. 6). In addition, Shaw and Barbuti (2010) report that these first-generation college students are less likely to persist in STEM majors than their continuing generation counterparts. Hoffer et al. (2003) further contend that all first-generation college students are underrepresented minorities in graduate, specifically doctoral, degree completion in STEM fields.

Background

The literature on women, underrepresented minorities, and first-generation students' experiences and performance in STEM degree programs provides extensive documentation about the numerous obstacles that they encounter in gaining access to and persisting in STEM fields (Chang, Eagan, Lin, & Hurtado, 2011; De Welde & Laursen, 2011; Griffith, 2010; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Pascarella, Pierson, Wolniak & Terenzini, 2004; Toutkoushian, Stollberg, & Slaton, 2018).

Ong et al. (2011) contend that much of the literature, which focuses on minorities in STEM or gender in STEM, overlooks the “double bind” of challenges that minority women experience: they are marginalized because of both their gender and race/ethnicity (p.176). Torres (2012) expands the analytical frame to include socioeconomic status in stating that “the interlocking systems of capitalism, patriarchy and racism” prohibit equity in STEM fields (p. 33).

Both the myth of meritocracy and the concept of the “null classroom environment” are detrimental to addressing equity issues in STEM. The application of Kelley and Streeter (1992) and Zamudio and Rios (2006) highlight that neither meritocracy nor the null educational environment are characterizations of STEM classrooms in American universities. Instead, Kelley and Streeter (1992) assert that STEM educational environments mirror broader university and societal contexts and are similarly structured by and reflective of patriarchy and male privilege. Zamudio and Rios (2006) argue that the problems extend beyond classrooms to college campuses in general that enable color-blind racism by sustaining white privilege and establishing it as the systemic status quo:

Material rewards and hegemonic structural relations continue to influence the attitudes and ideology of the white masses. . . . Not only do material rewards for whites motivate the persistence of racial attitudes, the activities (or just as often, the inactivity) of institutions serve to reinforce the new colorblind racism. (p. 484)

Zamudio and Rios (2006) provide a critical perspective with which to question the racial/ethnic differences in STEM degree completion and Kelley and Streeter (1992) offer reasons to question gender differences despite arguments that suggest that STEM environments are neutral and meritocratic. Furthermore, Torres (2012) suggests that inequities that students experience compound due to intersecting marginalized identities (e.g., race/ethnicity, gender, and socioeconomic status).

In “unpacking” McIntosh’s (1989) “invisible knapsack of white privilege” in the American university setting, we see how non-first-generation college students and specifically, white non-first-generation students come to college with an “invisible knapsack” that is filled with the contents of their white, middle-class privilege, which they unknowingly access and use during their college experience while remaining oblivious to the existence of these unearned resources. These resources are unavailable to their underrepresented minority low-income first-generation counterparts. The contents of this invisible backpack are all pieces of what, Bourdieu (1986) calls, “cultural capital;” the number of items contained in the backpack is determined by an individual’s social background, and the potential for accumulating more items to fill the backpack depends on an individual’s competence in society’s dominant values and behaviors. According to Bourdieu, families and schools, the main sources of cultural capital, both nurture and differentiate students. As a result, students’ cultural capital will convert into differentiated educational outcomes for students as well as social and economic returns.

STEM classrooms are both structured by and reflective of cultural capital, which according to Bourdieu (1973), is the knowledge, skills, and values of a society’s dominant class who in the United States is white, middle- and upper-class males. In other words, to succeed in STEM programs, students must not only master academic concepts or “official knowledge” in school, which reflects the values of the dominant class, but also acquire certain resources, knowledge, and skills (including technological devices and the skills to use them; critical reading, writing, and reasoning skills; and linguistic skills, such as the use of a certain diction and syntax) in order for their educational performance to be judged positively. Bourdieu (1986) contends:

The notion of cultural capital as a theoretical hypothesis . . . made it possible to explain the unequal scholastic achievement of children originating from different social classes by relating academic success, i.e., the specific profile which children from different classes and class factions can obtain in the academic market to the distribution of cultural capital between the classes and class factions. (p. 247)

In referencing Bowles and Gintis (1977), Pai (1990) explains how students from a society's dominant culture and class are able to manipulate, control, and thus gain an advantage in school systems. This advantage is possible, according to cultural capital theorists, because educational knowledge is not neutral, and instruction and evaluation are not based on a shared set of normative rules (Gao, 2011). Rather, the members of the dominant class and culture have the power and privilege to establish educational objectives and conduct student evaluations, which allow schooling to be structured by and reflective of their needs and goals, and is therefore, more beneficial to them.

Much of the existing literature on women, underrepresented minority, and first-generation college students in STEM fields approaches data, like Table 1 and Figure 1 shown below, that highlight the extent of underrepresentation of minority women in science and engineering fields from a deficit perspective: in other words, the literature questions: why are underrepresented minority and first-generation women graduate students completing degrees at a rate lower than men?

*Table 1:
Snapshot of Difference in U.S. Science and Engineering Master's and Doctoral Degree
Completion by Sex, Race, Ethnicity, and Citizenship Status*

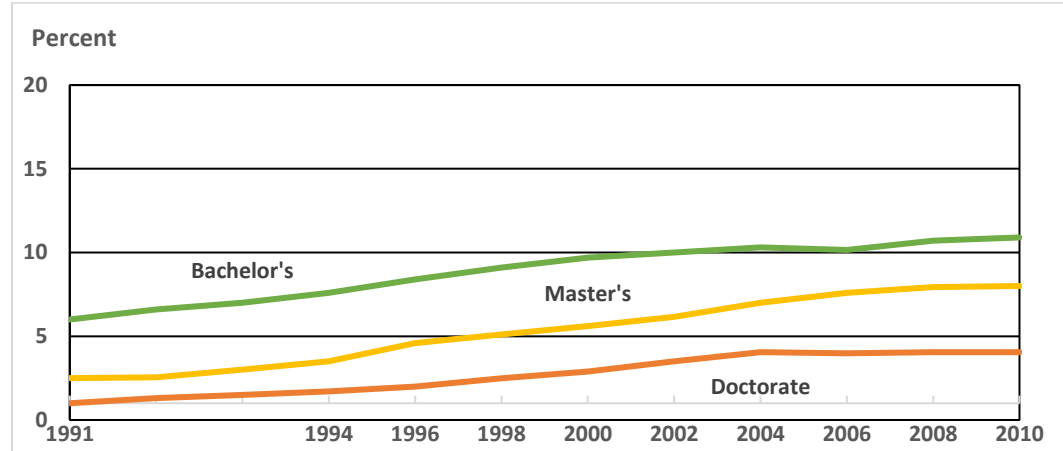
Field and sex		U.S. citizens and permanent residents								Temporary visa holders
		Hispanic or Latino ^a	Not Hispanic or Latino						Ethnicity and race not reported	
			American Indian or Alaska Native	Asian	Black or African American	Native Hawaiian or Other Pacific Islander	White	More than one race		
<u>Science</u>	Total									
Female	49%	4%	0%	3%	4%	0%	23%	1%	2%	12%
Male	51%	3%	0%	3%	2%	0%	23%	1%	2%	17%
Total	100%	7%	0%	5%	6%	0%	45%	2%	5%	29%
<u>Engineering</u>										
Female	24%	1%	0%	2%	1%	0%	6%	0%	1%	14%
Male	76%	3%	0%	4%	2%	0%	22%	1%	2%	41%
Total	100%	4%	0%	6%	2%	0%	29%	1%	3%	55%

SOURCE: Derived from: NSF (2014) Table 3-1 S&E graduate students, by field, sex, citizenship, ethnicity, and race: 2014 Retrieved from [Nsf.gov/statistics/2017/nsf17310/data/table3-1.pdf](https://nsf.gov/statistics/2017/nsf17310/data/table3-1.pdf)

Note: *Science degrees also include biological sciences, which have significantly higher participation of female students as compared to other STEM degrees and without which the percentages listed would be even lower.

Table 1 provides a snapshot of one year (2014) of all graduate science and engineering degrees awarded. The data highlight the fact that underrepresented minority women complete substantially fewer science and engineering graduate degrees than both white females and white males, and their completion of STEM graduate degrees is less than their proportion of the U.S. population would suggest.

Figure 1: Trends in Underrepresented Minority Women's STEM Degree Completion



Note: No data available for 1999

Source: Derived from National Science Foundation, National Center for Science and Engineering Statistics. (2013). *Women, minorities, and persons with disabilities in science and engineering: 2013. Special Report (NSF 13-304)*. Arlington, VA. Available at <http://www.nsf.gov/statistics/wmpd>

Figure 1 shows that a trend exists for underrepresented minority women's low graduate degree completion rates in science and engineering fields: the data suggest that women have not earned more than single digit percentages of postsecondary science and engineering degrees in the past almost 30 years despite the rapidly increasing employment market in STEM fields (Fayer, Lacey, & Watson, 2017). This low degree completion is surprising considering both Carnevale et al.'s (2012) and Pappano's (2011) arguments about higher education in the current economy. Carnevale et al. (2012) contend:

Our grandparents' high school economy has given way to the modern postsecondary economy. More and more, postsecondary education and training have become the threshold requirement for access to middle-class status and earnings, in good times and bad. Post-secondary education is no longer merely the preferred pathway to middle-class jobs –it is, increasingly, the *only* pathway. (p. 96)

Just as a high school degree has been replaced by a bachelor's degree, Pappano (2011) further suggests that a master's degree has become the new bachelor's. In quoting

a Hoover Institution education economist, Hanushek, Pappano (2011) notes that both the current “devaluing of the [undergraduate] college degree” and the “extra signaling power” of the master’s degree have created an environment in which a “bachelor’s [degree is] no longer an adequate screening measure of achievement for employers” (Hanushek, as quoted in Pappano, 2011, para. 11).

However, after examining the inequities that exist within educational systems and institutional cultures, which favor white, middle- and upper-class male students, this study approaches this discrepancy in graduate STEM degree completion from another angle and asks: what individual and institutional factors support underrepresented minority and first-generation women students in navigating their higher education institutions and their graduate STEM degree programs? What can higher education institutions do to improve underrepresented minority and first-generation women graduate students’ experiences in STEM graduate degree programs and increase their participation in them?

Purpose

The purpose of this study is to investigate the individual and institutional factors that underrepresented minority and first-generation women graduate students report as having contributed to their accessing and navigating through their graduate degree programs in STEM fields. Hence, this study seeks to identify the similarities and differences among the women participants’ experiences in their graduate STEM programs. In doing so, the study applies feminist standpoint theory, which recognizes that neither women nor underrepresented minority women are a monolithic group and seeks to further understand how women’s experiences are different from men’s and from each other’s. This study offers the women participants an opportunity to provide a counternarrative to this

prevailing deficit perspective in their own voices by inviting the women to share what individual factors have supported them not only in gaining access to graduate school but also in navigating the challenges that they have encountered in their graduate STEM programs. In addition, this study asks the women participants to share their perceptions of the institutional resources available to them and evaluate their utility in supporting them as underrepresented minority and first-generation women graduate students in STEM programs. The women's narratives are *testimonios* to their experiences as underrepresented minority and first-generation women graduate students in STEM fields.

Findings from this study provide insight into the individual and institutional values and resources that support underrepresented minority women in graduate STEM programs. Additionally, the findings highlight where intersections between students' support systems and institutional resources exist (or are lacking) and inform recommendations for ways in which universities can take the initiative to improve underrepresented minority and first-generation women graduate students' experiences in graduate STEM programs in order to increase their enrollment in and graduation from them.

Setting and Sample of the Study

To examine this issue within its context, this study focuses on one large, public research university in the Mid-Atlantic region of the United States (DMV hereafter) that is recognized not only for its racial and ethnic diversity but also for its dedication to improving campus issues related to all aspects diversity and inclusion (e.g. gender, disability, sexual orientation, etc.). With regard to the scope of campus diversity, DMV's Office of Diversity and Inclusion (2013) reports that approximately 48 percent of the more than 10,600 graduate students are women, and 20 percent self-identify as minority students.

Furthermore, according to a DMV University *Cultural Diversity Report*, DMV is one of the universities that awards the most minority undergraduate and graduate degrees in STEM fields. These statistics indicated that DMV University would be an excellent locale to facilitate an investigation into what factors of underrepresented minority and first-generation women graduate students' individual cultures and what resources within their institutional culture support their success in their STEM programs.

The five women (Alma, Bianca, Chelsea, Daniela, and Elizabeth) who participated in the study are all graduate students at DMV University in one of the following five STEM majors: aerospace engineering, astronomy, computer science, electrical engineering, and environmental chemistry. All of the women self-identify either as an underrepresented minority student or a first-generation graduate student or both. As graduate students, these women have already demonstrated success within their fields of study by completing their bachelor's degrees and by being accepted into advanced degree programs. As first-generation graduate students, the women have more insight into both the family and cultural assets and the institutional resources that have supported their success than their continuing generation graduate student counterparts who are more likely to be acquainted with the requirements and process of graduate school.

Although the focus of the study is on the perceptions of the women graduate students, which are ascertained through two semi-structured individual interviews and a focus group interview, two STEM faculty members who work in the computer science and engineering programs at DMV University also participated in interviews. The responses from these interviews offer another perspective on the institutional support available to women and minority graduate students in STEM fields at DMV University.

Research Questions

The following research questions guide this study:

1. What assets or strengths did underrepresented minority and first-generation women graduate students draw upon from their community cultural wealth (including funds of knowledge) in order to access and navigate through graduate degree programs in STEM fields?
2. What institutional factors do underrepresented minority and first-generation women graduate students identify as having contributed to their gaining access to and navigating through their graduate degree programs in STEM?
3. What similarities and differences do women students experience in navigating their higher education institutions?

Conceptual Framework

To provide a counternarrative to the large volume of deficit literature on women, underrepresented minorities, and first-generation college students, this study employs the conceptual framework, community cultural wealth. Community cultural wealth is similar to but distinct from the concept of cultural capital. Yosso's (2005) concept of community cultural wealth challenges the confines of Bourdieu's (1973) cultural capital by reframing the lens with which communities of color are viewed: rather than viewing minority students in terms of the deficits they possess in comparison to their majority counterparts; community cultural wealth highlights the assets that these students and their communities possess.

To explore the women students' individual strengths, this study presents and analyzes the data collected from the women's testimonios through Yosso's (2005)

community cultural wealth conceptual framework. This study also applies Veléz-Ibañez and Greenberg's (1992) funds of knowledge. Although other scholars (Moll, Amanti, Neff & Gonzalez, 1992; Kiyama, 2010) apply funds of knowledge as its own conceptual framework, this study includes it as a specific asset within Yosso's (2005) familial capital.

Significance of the Study

The findings from the testimonios presented in this study add to the literature that uses Yosso's (2005) community cultural wealth as a conceptual framework by expanding its application both to other underrepresented minority populations in the United States and to advanced, highly technical STEM fields. Although Espino (2014) applies this conceptual framework to examine Mexican American doctoral students' access to and persistence in their graduate programs, this study further broadens its application to additional underrepresented minority groups in graduate STEM degree programs.

In expanding the cultural backgrounds to which this conceptual framework has been previously applied, this study broadens the current concept of underrepresented minorities to include women from Middle Eastern/North African populations. The study also extends the term first-generation students to include first-generation graduate students (students who have at least one parent with a bachelor's degree but no graduate degree). This reconceptualization of the terminology provides for greater insight into the individual and institutional factors that support the most underrepresented women students' success in graduate STEM fields. This information has implications for educational policies and practices that are designed to increase underrepresented minority and first-generation graduate students' participation and improve their experiences in graduate STEM degree programs.

A cannon of literature exists to document the challenges that women, underrepresented minorities, and first-generation graduate students encounter in accessing and participating in STEM degree programs. Contrary to the previous literature that discusses women, underrepresented minority and first-generation college students' participation (or lack thereof) in STEM programs from a deficit perspective, the women's *testimonios* in this study serve as a counternarrative that reframes the conversation.

Key Terms

STEM. Although the acronym STEM stands for science, technology, engineering and mathematics, Chen and Weko (2009) suggest that neither a universal definition of STEM fields nor a list of specific academic majors and occupations that constitute STEM exist. Rather, they argue that STEM can encompass all mathematics disciplines, natural science disciplines, computer and information sciences, all fields of engineering, as well as social sciences, such as economics or political science. The NSF (2017) report on *Women, Minorities, and Persons with Disabilities in Science and Engineering* highlights trends that indicate the largest racial/ethnic and gender disparities are in four STEM fields: computer science, engineering, physics, and mathematics. The women participants in this study are graduate students in one of the five following STEM fields: aerospace engineering, astronomy, computer science, electrical engineering, and environmental chemistry.

Underrepresented minorities (URMs). Section 1067k(2) of Chapter 28 of the *U.S. Code*, Title 20 defines minorities in STEM fields as “American Indian, Alaska Native, Black (not of Hispanic origin), Hispanic (including persons of Mexican, Puerto Rican, Cuban, and Central or South American origin), Pacific Islander or other ethnic group

underrepresented in science and engineering” (20 U.S.C. § 1067k(2), 2011). According to NACME (2013), African Americans, American Indians/Alaska Natives, and Latinos/as are particularly underrepresented in STEM fields. However, this study also includes a woman from the Middle East/North Africa (MENA). Although Islam (2017) reports that women in the Middle East both out number and outperform their male counterparts in STEM education, less information is available about their participation or performance in STEM in the United States, as they are aggregated into the statistics of white female students. U.S. Census Bureau, American Community Survey estimates suggest approximately 0.5 percent of the U.S. populations is of MENA descent; however, the Arab American Institute insists that this statistic is at least three times larger (Arab American Institute, 2009-2018). Both statistics indicate that MENA women in America are a small minority of the white category to which they are aggregated. In viewing these statistics within the context of STEM education, MENA women are in all probability an even smaller minority. Section 1067k(5) within Chapter 28 of the *U.S. Code* Title 20 states:

The term “underrepresented in science and engineering” means a minority group whose number of scientists and engineers per 10,000 population of that group is substantially below the comparable figure for scientists and engineers who are white and not of Hispanic origin. (20 U.S.C. § 1067k(5), 2011)

If the MENA population were disaggregated from white, statistics would likely show that this population, and especially the subgroup of women, are underrepresented in science and engineering fields in the United States. Furthermore, although MENA women in America are not considered historically underrepresented minorities, Considine (2017) provides justification for their inclusion in her study on the increase in anti-Arab and anti-Muslim sentiment and discrimination in the United States, which, she explains, “plays out at the social/interactional as well as institutional level” (p.13).

First-generation. This study applies the term first-generation to describe the five women participants who are among the first-generation of their families to go to graduate school. The term (first-generation) is typically used to describe an undergraduate university student “whose parents never enrolled in postsecondary education” (Nunez, & Cuccaro-Alamin, 1998, p. v). However, research also suggests that multiple definitions with divergent criteria exist for this term (Ishitani, 2006; Toutkoushian et al. 2018). No matter which definition is used, the term indicates a distinction between two groups of students (first-generation and their continuing generation counterparts) in their access to knowledge, skills, and resources, which are beneficial to their experience in higher education. Alberti (2001) suggests that the term first-generation itself is problematic because it minimizes the significant differences between the backgrounds, resources and experiences of these students in comparison to their continuing generation counterparts. In explaining this argument, Alberti (2001) writes:

The term “first-generation” itself potentially obscures the class implications of being such a student in order to minimize the potentially radical significance of these differences, differences that signify a level of conflict and change beyond the capacity of most traditional institutional structures to handle. (p. 581)

Culture. The title of Baldwin, Faulkner, Hecht, and Lindsley’s (2006) book chapter, “A Moving Target: The Illusive Definition of Culture,” frames the difficulty that surrounds providing a precise or universal definition of culture. Baldwin et al. (2006) discuss how the term culture is defined in countless ways and contend that the term itself only acquires meaning through the definitions that people provide. In agreeing and aligning with Baldwin et al. (2006), I encouraged each participant in this study to describe the aspects of both her individual and institutional culture that she felt were relevant or important to her identity, experience, and success. The information from the women’s *testimonios* highlight

similarities and differences in their understanding of both individual and institutional culture. Although the interview guide prompted the women to discuss cultural knowledge, traditions, experiences, and sayings as components of their individual cultures, the women could determine themselves what they considered to be cultural traditions (e.g., activities, rituals, customs, beliefs, behaviors, social norms, etc.) or knowledge (e.g., skills, language, values, practices, etc.) and how they interpreted and understood any relevant sayings.

Like the ambiguity in the definition of individual culture, no universal consensus exists about what elements constitute institutional culture. Tierney (1988) applies Geertz's (1973) claim that a person's culture is made up of "webs of significance that he himself has spun" to describe university culture and writes that it is "an interconnected web that cannot be understood unless one looks not only at the structure and natural laws of that web, but also at the actors' interpretations of the web itself" (p. 4). In agreeing with this description of institutional culture, this study offered opportunities for the women participants to discuss the webs of significance to their interpretation of university culture.

The interview guide also asked about relationships with students and faculty, policies or practices in classrooms and on the university campus, and support or validation given to students. While these topics encouraged conversation about the university culture, the women also discussed the specific elements important to their individual interpretation of and experience in the university culture including funding, campus employment (research assistantships and teaching assistantships), relationships with and among faculty, departmental structure, extracurricular activities, health facilities, multiculturalism and diversity, support for graduate student partners, etc.

Keup, Walker, Astin, and Lindholm (2001) describe another important aspect of institutional culture, which is that “elements of culture are usually unspoken tenets that are often taken for granted” (p.2). These “unspoken tenets” are rules that inform and guide processes, interactions, relationships, and values that serve as the status quo of university operations and experiences. The interview and focus group conversations encouraged women participants to provide examples of these “unspoken tenets” of university culture, and question why they are accepted as norms. Because there is no universal definition of individual or institutional culture, the participants’ voices are imperative to understanding and explaining the cultural aspects that affect their experience in their graduate STEM programs and contribute to their success.

Organization of the Study

This study is presented in seven chapters. The first chapter is this introductory chapter, which provides some background on the issue, explains the purpose of the study, lists the research questions, describes the setting and sample of the study, and indicates the conceptual framework that guides the research questions and analysis. This chapter also explains the significance of the study and indicates how it addresses gaps in existing literature on the topic of underrepresented minority and first-generation women graduate students’ participation in STEM fields. In addition, the chapter defines important terminology used throughout the study. Chapter two is a literature review that offers an overview of the assets and challenges of women students in STEM fields, underrepresented minority students in STEM fields, and first-generation college students in STEM fields, as well as any intersections discussed in the literature. Chapter three provides an overview of the methodology. The third chapter explains why qualitative methodology was chosen over

quantitative methodology to answer the study's three research questions. In addition, chapter three also describes how the study uses data from *testimonios*, interviews, observations of nonverbal communication (during the interviews and focus group session), and a focus group, as well as the proposed data analysis using the conceptual framework of community cultural wealth. This chapter also lists the limitations to the methods used. Chapters four, five, and six present the findings corresponding to each one of the study's overarching research questions. Chapter seven, the final chapter, discusses the findings in more detail, offers implications for practice and research, and presents conclusions.

CHAPTER TWO: LITERATURE REVIEW

Introduction

This literature review first provides a brief overview and critical evaluation of the way in which existing education research presents issues surrounding the participation of underrepresented minorities, first-generation students, and women in STEM degree programs. Then, it presents Tinto's (1975, 1988) model of student retention, which is a widely applied theoretical model to examine student retention in higher education, discusses criticisms of this model, and offers an analysis of alternatives. The next section presents an overview of Yosso's (2005) community cultural wealth, the study's guiding conceptual framework, and describes its application. The final section reviews other studies that apply these frameworks and indicates where this study fills a gap in the literature.

The literature highlights statistics that show how the United States is becoming increasingly diverse and the ways in which this diversity is finally starting to be reflected in the American university enrollment trends. According to the U.S. Department of Education, National Center for Education Statistics (2018), the percentage of American college students who are minorities (including Hispanic, Asian/Pacific Islander, Black and American Indian/Alaska Native) is on the rise:

From fall 1976 to fall 2015, the percentage of Hispanic students rose from 4 percent to 17 percent of all U.S. residents enrolled in degree-granting postsecondary institutions, and the percentage of Asian/Pacific Islander students rose from 2 percent to 7 percent. The percentage of Black students increased from 10 percent in 1976 to 14 percent in 2015, but the 2015 percentage reflects a decrease since 2011, when Black students made up 15 percent of all enrolled U.S. residents. The percentage of American Indian/Alaska Native students was higher in 2015 (0.8 percent) than in 1976 (0.7 percent) (para. 9).

In fact, racial and ethnic minority students now comprise one third of all American university students. However, African Americans, Latinos, American Indians/Alaska

Natives are significantly underrepresented in STEM programs, and this underrepresentation increases at each subsequent degree level (Garrison, 2013). De Welde and Laursen (2011) explain that women from these demographic backgrounds have even greater disparities in their participation and degree completion in STEM higher education: “Women make up less than a quarter of U.S. doctoral recipients in most physical science and engineering fields, and Black, Hispanic, and Native American women are especially poorly represented (p. 572). These statistics are significant in thinking about the changing demographics of American higher education institutions and the implications that this population shift has for the role of universities in supporting student success.

The Diversity Imperative

Much of the literature that documents the benefits of increasing underrepresented minorities’ and women’s participation in STEM focuses on the potential economic gains for the United States in having a larger and more diverse STEM workforce (Carnevale et al. 2012; Dychtwald, 2010; Museus et al. 2011). The statistics above, which highlight the increasingly diverse nature of both the United States population in general and its subset of American college students, support this financial assertion. The argument is that the incorporation of diverse voices and ideas into STEM fields is important because different demographics of people (e.g., gender, race, ethnicity, socioeconomic status) tend to approach and address issues in very distinct ways.

Federal programming reflects this sentiment and provides support through its public rhetoric. For example, the Committee on STEM Education (CoSTEM) of the National Science and Technology Council’s 2013 Federal Science, Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Plan indicates that

targeted policy attention should be directed toward increasing the graduation rates of “traditionally underrepresented groups” at high school, undergraduate, and graduate levels. However, the rationale provided in support of this focus is related to national economic imperatives rather than any deliberate social justice-oriented initiative. The Federal STEM Education 5-year Strategic Plan (2013) states: “These students deserve special attention and must be a deliberate part of any national strategy because they [underrepresented groups] offer an expanding pool of untapped talents and are a large underutilized source of potential STEM professionals” (p. 32). The NSF (2003) Research on Gender in Science and Engineering Program Solicitation uses similar language. While this program awards federal grant funding to proposals that are designed to increase women’s participation in STEM education, this type of language again implies that women’s greater participation in STEM is only instrumental to developing a more diverse workforce that will optimize the fields of science and engineering rather than a goal itself. In their article, “Without Inclusion, Diversity Issues May Not Be Enough,” Puritty et al. (2017) explains that the problem with these types of diversity initiatives is that they focus primarily on recruiting a larger and more diverse body of students into STEM without making any structural changes to programs and institutions or broader systemic changes.

The Deficit Perspective

Much of the literature on underrepresented minority, first-generation, and women students in STEM within this diversity imperative paradigm myopically focuses on topics related to educational access rather than improving equity in educational experience; the quantitative studies report and examine statistical trends while the qualitative studies investigate the factors that contribute to these students’ increased enrollment in and

graduation from STEM degree programs (or lack thereof). This discussion primarily centers on the individual factors (of the students) and evaluates them in comparison to their white, male counterparts (Cole & Espinosa, 2008; Griffith, 2010; May & Chubin, 2003).

Underrepresented minority students. For example, both Cole and Espinoza (2008) and Griffith (2010) use regression analyses to examine what factors contribute to underrepresented minority students' persistence in STEM: both studies conclude that individual factors are essential to students' persistence. Cole & Espinoza's (2008) regression analysis gauged the extent to which Latino students' academic performance measured by GPA can be explained by individual (e.g., parents' level of education and high school GPA), institutional (e.g., public vs. private institution), or environmental (e.g., peer study groups and diversity-related events) factors. Cole and Espinoza (2008) found that parents' level of education did not have a significant impact on Latino students' GPAs in college. However, the students' high school GPA scores were able to account for approximately one third of their persistence: students with higher high school GPAs were more likely to persist and have higher GPAs in their college STEM majors. The researchers also note that students' academic preparation is important to their academic performance in their college STEM programs: "high school GPA seems to be the most salient independent variable explaining Latino students' GPA after 4 years of college" (Cole & Espinoza, 2008, p. 298). Griffith's (2010) study, which used data from the National Longitudinal Survey of Freshmen (NLSF) and the National Educational Longitudinal Study of 1988, also suggested that individual factors, such as educational preparation in STEM subjects (as indicated by the number of high school Advanced Placement STEM classes and grades earned during the first two years in college) explain much of the

difference in persistence between the underrepresented minority and majority student populations.

In addition to individual factors, both studies acknowledge that institutional factors also play a role in minority students' persistence and performance in STEM majors; however, the findings, as the authors admit, warrant further investigation. Cole and Espinoza (2008) found that attending campus diversity functions and peer study groups negatively affected Latino students' performance in their STEM classes, which is contrary to previous research that suggests peer networking, and specifically peer networking in STEM, is beneficial to minority students' persistence in their fields of study (Fries-Britt, 1998; Tsui, 2007). Griffith (2010) found that the racial and ethnic diversity of STEM departments did not have a significant effect on minority students' persistence but noted that the presence of graduate student underrepresented minority peer mentors was influential to students' persistence.

While these studies highlight that relationships exist between both academic preparation and institutional factors and minority students' persistence in STEM fields, the nature of regression analyses causes reason to question what these findings can actually infer about underrepresented minority students' persistence (or lack thereof) in STEM education. Klees (2016) provides two reasons to question the validity of these findings and to be wary of other studies that use similar methods: (1) "sufficiently complete" theories do not exist in the field of education but are needed to develop models that can identify causation and (2) "with just one omitted variable, all regression coefficients may be biased to an unknown extent and in an unknown direction" (p. 86). For example, while the institutional environment undoubtedly affects students' persistence, variables that could be

missing from Cole and Espinoza's (2008) regression analysis include the amount of or scheduled time of the campus diversity events or study groups. Although Griffith (2010) found that departmental diversity may not be important, a variable that may be missing from her study is a measure of the campus diversity.

In addition, Cole and Espinoza's (2008) small sample size of 146 Latino students and the overrepresentation of private universities in the study, at approximately 68 percent, limit the generalizability of their findings regarding the importance of academic preparation to minority students' success in STEM majors. However, other literature (Childs, 2015; May & Chubin, 2003) supports these findings with their discussions on the salience of minority students' academic preparation to their success in STEM disciplines. Some studies (Bean & Metzner, 1985; Tinto, 1975) place the blame for any lack of success on the individual students; however, both Cole and Espinoza (2008) and Griffith (2010) fault education systems rather than the individual students for their lack of sufficient academic preparation for college STEM courses.

First-generation students. Within the literature, a divide exists in the research foci in relation to first-generation students: on one hand, research highlights the obstacles and challenges of first-generation students in postsecondary education (Choy, 2001; Griffith, 2010; King, 2012) and specifically in STEM degree programs (Hoffer et al., 2003; Museus et al., 2011; Shaw & Barbuti, 2010). On the other hand, research shows how the assets (skills, knowledge, values, and experiences) that first-generation students bring to their classrooms help them to succeed (Banks-Santilli, 2015; Gofen, 2009). Banks-Santilli (2015) summarizes this dichotomy:

There is considerable stigma associated with first-generation status. As a result, some of these students may choose to remain invisible. Once they identify, their

academic ability, achievement and performance may be underestimated by others. Their background is viewed as a deficit rather than a strength. And they are unnecessarily pitied by others, especially if low income. . . . But, there is another side to the story as well. There are first-generation students who view their status as a source of strength. It becomes their single most important motivator to earning their degree. These students are driven and determined. They can perform academically in ways that are equal to or even better than students whose parents have earned a degree. (p.1)

Much of the research on first-generation college students compares them to their non-first- generation counterparts by highlighting statistics that show disadvantages that they experience related to enrollment rates and patterns (two year vs. four year institutions; public vs. private institutions), retention (persistence vs. dropout rates), achievement (GPA, academic majors, degrees awarded), attainment (types of degrees awarded, time taken for degree completion), and outcomes (long-term occupational status and salaries) (Chen & Weko, 2009; Engle, 2007; Nunez & Cuccaro-Alamin, 1998; Pascarella et al., 2004). The research also highlights the psychosocial issues with which first-generation students grapple due to the lack of support or even outright discouragement from family and friends. Striplin (1999) explains how families of first-generation students can discourage their educational pursuits, which can set them against their families and negatively impact their academic self-efficacy: “they think they are not college material” (Striplin, 1999, p. 2). Espino (2014) suggests that the doubts plaguing first-generation students are not limited to their undergraduate education. In fact, the Mexican women doctoral students that she interviewed indicated that these doubts may be even more serious in graduate school because “elitism and power dynamics are even more pronounced within graduate school socialization processes” (Espino, 2014, p. 568).

Women in STEM. The deficit literature on women in STEM highlights their lack of enrollment (Miller & Wai, 2015) and persistence in STEM majors at both the

undergraduate (Griffith, 2010) and graduate degree levels (MacLauchlan, 2012), as well as describes the challenges that they encounter in their STEM degree programs. Frequently noted challenges include gender bias (Moss-Racusin et al., 2012), imposter syndrome (Ivie, White & Chu, 2016), and what De Welde and Laursen (2011) describe as “a glass obstacle course” (p. 571). This “glass obstacle course,” according to De Welde and Laursen (2011), is a metaphor that explains the challenges that women face during their academic trajectory, which are “unseen” and often unnavigable (p. 571). According to De Welde and Laursen (2011), this metaphor is distinct from other glass metaphors (glass ceiling or glass cliff) because it highlights how these obstacles “are not static, one-time experiences that can be permanently conquered.... Rather, the barriers themselves are in action – popping up out of nowhere again and again” (p. 574). Some examples of such barriers include sexism/harassment, lack of female role models, work-family balance, and the exclusion from the “Old Boys Club,” conditions which characterize graduate STEM fields (De Welde & Laursen, 2011). Although De Welde and Larsen (2011) note that women STEM students experience these same obstacles in their undergraduate studies, they suggest that these challenges are amplified by the time they get to graduate school simply because fewer women apply to and complete graduate degrees in STEM fields.

Much of the literature on underrepresented minority, first-generation, and women students in STEM programs details the challenges that students face and the deficits they have. Some of the literature, as Margolis and Fisher (2002) aptly note, recognizes that many of the challenges that women face in STEM programs “must be acknowledged as an institutional problem,” which places the burden on the university (not the student) to address it; however, the literature does not acknowledge the assets that the student brings

with her to successfully handle these challenges (p. 92). Additionally, the existing literature is missing these students' voices on the utility of institutional supports and strategies that are implemented to address the aforementioned challenges.

Intersecting identities and overlapping challenges. As shown earlier, many first-generation students have intersecting identities and, therefore, encounter overlapping challenges in navigating institutions of higher education. Hochschild (2003) calls this issue “nested inequalities” wherein “class biases are closely entwined with racial and ethnic inequalities” and negatively impact students' academic achievement and ultimately attainment: in other words, Hochschild (2003) explains, the poor in the United States are predominately African American or recent immigrants, and “American schools too often reinforce rather than contend against those structures” (p. 1). Using Gloria and Kurpius' (1996) concepts of “home” culture and “university culture,” Cole and Espinoza (2008) explain how underrepresented minorities are confronted with challenges in navigating college curricula and campuses because they “typically reflect White male, middle-class perspectives” which are discordant with their own (p. 288). This situation is especially difficult for underrepresented minority women in graduate STEM programs (MacLachlan, 2012): they have different demographics (race/ethnicity) *and* socioeconomic status *and* gender than their continuing generation college students (who are usually white, middle or upper-class males).

Tate and Lin's (2005) application of a multiple identities framework to their analysis of interviews with five minority women undergraduate students in STEM majors provides insight into the overlapping challenges that minority and first-generation women in STEM experience. Their findings highlight the women's “feelings of difference and a

sense of not belonging” (p. 491). In STEM fields, the research suggests that difference is both related to their gender and minority status. Tate and Lin (2005) suggest that women of color engineering students have multiple identities: academic, social, and intellectual that are specific to different contexts. For example, although women of color students were engaged in their coursework and persisted throughout their degree, Tate and Lin (2005) note that these students shared in the interviews that they “were plagued with feelings of difference and a sense of not belonging” (p. 491). In other words, while the women’s academic identity might suggest a positive situation, their social identities, as presented in the interview data, may indicate otherwise. This study further supports the argument that persistence or retention statistics do not provide sufficient information with which to understand and effectively support students in their STEM academic trajectories. Tate and Lin (2005) write:

If this study had only considered students' persistence in their engineering program, our results would have only shown these women as successful students with the same experiences as most of their peers. By taking into account students' social identity in the academic context, we begin to understand the salience of race or gender in their experiences. (p. 491)

Although Tate and Lin’s (2005) study focused on the intersection of gender and race, other social and economic factors, such as socioeconomic status or being a first-generation college student, could provide more details relevant to understanding and supporting any population of underrepresented STEM students. Furthermore, in reflecting on the findings from Espino’s (2014) study, gaining this understanding about underrepresented minority and first-generation women students in graduate STEM programs is particularly important, especially since students reported that the feelings of self-doubt and isolation had compounded in higher levels of education.

Although Espino (2014) contends that doctoral programs in non-STEM disciplines may have additional challenges (lack of funding and cohort groups), graduate students with multiple minority characteristics (gender, underrepresented race/ethnicity, first-generation status) in STEM programs encounter difficulties (MacLachlan, 2012) and often do not persist in their graduate degree programs (Hoffer et al., 2003).

Models of Student Retention

Deficit thinking leads to departure: Reflections on Tinto (1975, 1988). In initiating the discussion on student retention, Tinto (1975; 1988) proposed a theoretical model that explains student departure from (or retention in) higher education institutions. Tinto (1975) applied Durkheim's (1961) sociological theory of suicide to students' integration in higher education to suggest that students who are either unwilling or unable to integrate into the academic and social circles of their higher education institution are likely to drop out, an act which he contends is "analogous to that of suicide in the wider society" (Tinto, 1975, p. 91). The student's integration into or, conversely, departure from the university can be predicted by "individual characteristics," (e.g., student's previous educational experiences and preparation, sex, personal goals, and etc.); an individual's "interaction within the college environment" (e.g., student's academic performance and level of involvement in extracurricular activities); "institutional characteristics" (e.g., type, which is defined as two-year or four-year and public or private; and quality of institution, which is not clearly defined but is correlated with type, as well as having a both a larger percentage of faculty with doctorates and students from higher income families) (Tinto, 1975).

Tinto (1988) expands upon this concept of student retention by suggesting that students who attend college follow a similar three-stage trajectory (separation, transition, and

incorporation) to establish their membership within their college community and ultimately must successfully pass through all three stages in order to complete their degree. Informed by sociological anthropologist Van Gennep's (1960) work on tribal communities' ceremonial rites of passage, the three stages include "separation," "transition" and "incorporation" (Tinto, 1988; Van Gennep, 1960). The students must first disassociate from their previous communities (separation), then familiarize themselves with the beliefs and behaviors of their college peers (transition), and finally, fully integrate themselves into the collegiate community by adopting these new beliefs and behaviors (incorporation). Although Tinto (1988) concedes the successful completion of these phases will not occur without challenges, the individual student is almost wholly responsible for her/his own success: "it is the individual's response to those conditions that finally determines staying or leaving" (Tinto, 1988, p. 445). Tinto is considered the pioneer of the theoretical interpretation of individual student success: his theoretical model centers on the student and what attributes enable retention in or facilitate departure from undergraduate studies.

Tinto (1988) acknowledges that this process of integration may be more difficult for those students whose social, cultural, and economic backgrounds are radically different from the majority of their college community: "In the 'typical' institution, one would therefore expect persons of minority backgrounds and/or from very poor families, older adults, and persons from very small rural communities to be more likely to experience such problems than other students" (Tinto, 1988, p. 445). In responding to these inequities, recent research (Espino, 2014; LeSavoy, 2010) rejects Tinto's theory and faults it for what LeSavoy (2010) describes as the "onus it places on underrepresented students who must lose their own cultural identities in order to assimilate into predominately white

institutions” (p. 87). In his more recent work, and perhaps in response to these critiques, Tinto (1993) concedes that the term “incorporation” wrongly connotes a mandatory detachment of cultural identity in order to adopt that of the mainstream student body and thus replaces it with “membership.” Furthermore, Tinto (1997) acknowledges that universities can and should make efforts to support students during the transitional periods when they attempt to gain membership, especially in regard to their academics. Such support includes changes in pedagogy that promote the creation of “learning communities,” which encourage students’ academic and social membership, as well as “cooperative teaching,” which provides students with more than one perspective on subjects discussed in class (Tinto, 1997, p. 620).

Although these practices assist students in gaining a sense of belonging, where Tinto differs from his critics is that he does not question who defines university culture and what constitutes success within it: a situation that LeSavoy (2010) refers to as Tierney (2000) and Rendón, Jalomo and Amaury’s (2000) “institutional-centered acculturation” in which minority students are forced to change their cultural beliefs and behaviors in order to fit in academically and socially on campus and complete their degree programs (p.96). In recognizing the validity of these criticisms, I began to look for alternative models on student retention that focused on preserving, uplifting, and incorporating the assets of students’ cultures rather than on maintaining and enforcing the cultural capital of the institution.

Analysis of alternatives to student departure: Models of retention. Some institutions such as the University of Montana, Department of Social Work, Stone Child College, Salish Kootenai College, and the University of California - Berkeley have begun

to examine the role of higher education institutions in facilitating student success (retention and graduation rates) through a critical lens, ultimately broadening both role of the institution and diversifying the student body (Guillory & Wolverton, 2008; Harris III & Bensimon, 2007; HeavyRunner & DeCelles, 2002; Matsui, Liu, & Kane, 2003). One such example can be found in the Family Education Model (FEM) presented by HeavyRunner and DeCelles (2002): the FEM is an indigenous-based model of student retention that supports Native American students' success by incorporating their cultural backgrounds into their university campus experiences at the above-mentioned institutions in Montana. This model reproduces the Native American extended family structure in universities and has a family specialist who works directly with students and families in a variety of ways, from serving as an advisor and counselor to a ceremonial event planner (Guillory & Wolverton, 2008; HeavyRunner & DeCelles, 2002). The goal of the model is to help Native American students to balance family and school responsibilities.

The Biology Scholars Program (BSP) at University of California–Berkeley (UC Berkeley) provides another example of an institution taking a more proactive role to encourage student success. The program supports students from low-income backgrounds and/or who are the first in their families to attend college, as well as underrepresented minorities (women, African American, Hispanic, and American Indian) to not only graduate from the biology program at UC Berkeley but also apply to and receive acceptance from graduate school (Matsui et al., 2003). The program provides a community for students to academically and socially interact with classmates from similar backgrounds. Additionally, the program provides guidance and support (mentoring and advising) to students regarding coursework, internships, and career planning. Although the students

who participate in this program typically come from academically and economically disadvantaged backgrounds, Matsui et al. (2003) report these students graduated with a bachelor's degree in biology at the same rate as non-URM students and more than twice the rate of URM students who did not participate in the program. In addition to encouraging retention and graduation, the program expands the notion of student success to include graduate school enrollment. The program website indicates: "From 2004-2011, 85% of BSP medical school applicants who actively and frequently participated in advising and study groups were admitted as compared to a national admissions average of 50% and a UC Berkeley average of 55%" (University of California Regents [UC Regents], 2018, para. 3). The medical school acceptance statistic is even higher for BSP underrepresented minority students (96%), as compared to their underrepresented minority counterparts at Berkeley who did not participate in the program (35%) (UC Regents, 2018).

Although the two models mentioned above help to facilitate success for low income and minority students, as well as foster a broader definition of success, they, like the majority of institutions according to Guillory and Wolverton (2008), fall short of making systemic changes. The authors (2008) explain the trajectory of institutional change with Richardson and Skinner's (1991) Model of Institutional Adaptation to Student Diversity (MIASD):

The *reactive stage* occurs when institutions are under pressure to improve their equity performance for minority groups and react by focusing their diversity efforts solely on new recruitment initiatives, retooling financial aid packages, and special admission programs for minority students. The *strategic stage* is a product of the success of the reactive stage as institutions develop outreach, transition, and academic support services designed to help a more diverse student population adapt to the university environment. The last, the *adaptive stage*, is characterized by institutional assessment, learning assistance, and curricular renewal. Faculty members become involved in this stage to change educational practices, curriculum

content, and teaching practices. (Richardson & Skinner 1991, 7, as cited in Guillory & Wolverton 2008, p. 63)

Both the FEM and the UC Berkeley BSP fall within the strategic stage of Richardson and Skinner's (1991) model: they provide services that help a more diverse body of students achieve success without altering the status quo of the university culture.

The Equity Scorecard,TM which was developed by Dr. Estela Bensimon of the University of Southern California's (USC) Center for Urban Education, goes one step further to the adaptive stage. Rather than focusing simply on predetermined definitions of access, retention, and success this scorecard assesses an institution's efforts to not only acknowledge but also address inequities. The Equity ScorecardTM puts the onus of responsibility for integration and achievement on the institutions rather than the individual student. Instead of encouraging underrepresented minority students to disassociate themselves from their cultural backgrounds, this model helps institutions to evaluate their efforts to integrate these students into university classrooms and campuses and identify where work remains to be done. This model:

shift[s] the focus away from commonly held beliefs in which responsibility for academic success and failure rests entirely with students. Instead, they [university faculty, administrators, and staff] begin to ask what their institution, and they themselves, can do to improve results. (Center for Urban Education, USC, n.d., para 7)

Harris III and Bensimon (2007) explain how this model has provided guidance for institutions to conduct studies of their own that reevaluate their best practices in order to help "students who are not familiar with the hidden curriculum of how to be a successful college student," and address and ameliorate unequal educational outcomes (p. 80).

Although the Equity Scorecard would fall within the adaptive stage of Richardson and Skinner's (1991) model because it adapts the institutional support to students' diverse

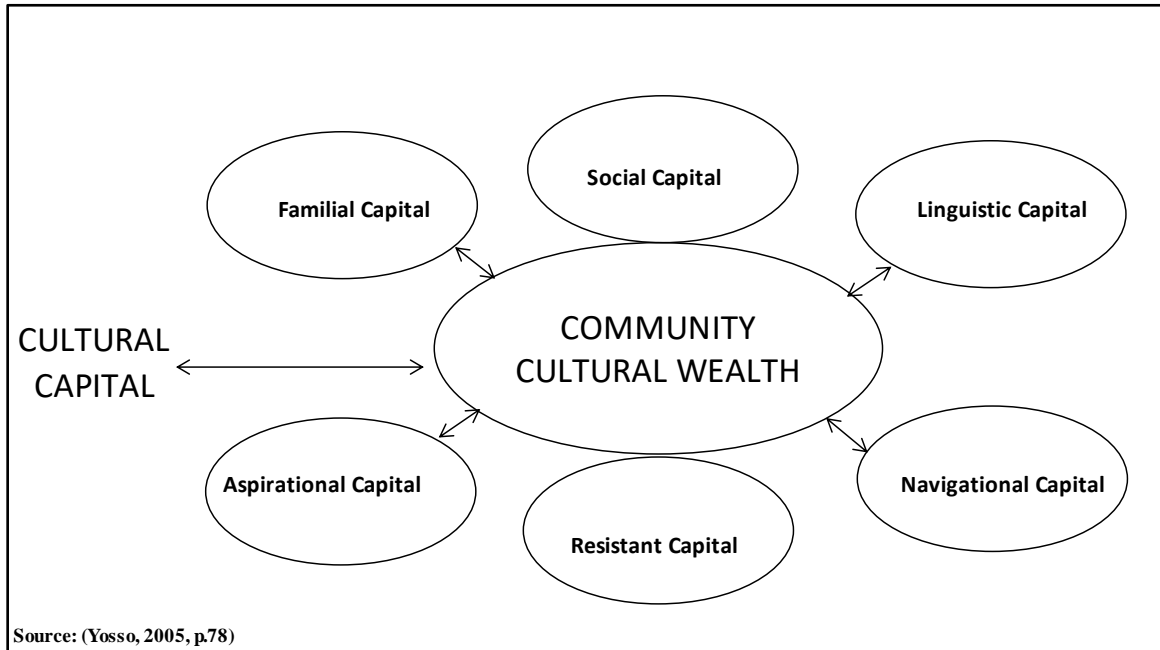
needs, it neither creates transformative change within the institution nor ceases to view students from a deficit perspective. For example, Harris III and Bensimon (2007) describe how the Equity Scorecard provides additional support to students who struggle with learning “the hidden curriculum of how to be a successful college student;” however, it does not question the purpose or the merit of that hidden curriculum (p.80). Furthermore, it does not incorporate any of the students’ own knowledge, skills, or values into the hidden curriculum or institutional culture. After reading these alternative examples, I was left wondering, what information would be needed to create a counternarrative to the deficit perspective with which these students are viewed? What information would be needed to create a transformative change of institutional culture? I found the answers to those questions in the Yosso’s (2005) community cultural wealth, which serves as the guiding conceptual framework for this study.

Conceptual Framework: Community Cultural Wealth

This literature review shows the ways in which many educational research studies view underrepresented minority and first-generation college students from a deficit lens that focuses on the challenges that they face in STEM disciplines. One framework, community cultural wealth, offers a unique asset-based perspective. Developed by Yosso (2005), community cultural wealth is a six-part model that includes aspirational, familial, social, linguistic, navigational, and resistant forms of capital (See Figure 2). Yosso (2005) describes how the evaluation of students’ academic performance and scholars who write about it both privilege white middle- and upper-class experiences, knowledge, and values and devalue the cultural assets that students of color bring to the classroom. Community

cultural wealth reframes this discussion by highlighting these assets and reveals the ways in which they are valuable to students and their educational success.

Figure 2: Yosso's Model of Community Cultural Wealth



Aspirational capital, according to Yosso (2005), includes students' and their families' "hopes and dreams for the future" (p. 77). Yosso (2005) explains how families have high expectations for their children's education and futures despite not always having the means with which to realize these expectations; however, the aspirations themselves cultivate a motivating "culture of possibility" (p.78).

Familial capital includes the values, knowledge, and skills that students learn from their families or cultural communities and bring with them to their classrooms. Another important component of familial capital is the care and support of extended family and kinship networks. Yosso (2005) includes Veléz-Ibañez & Greenberg's (1992) concept of funds of knowledge as part of familial capital. Funds of knowledge involves the transference of everyday familial and cultural knowledge and skills. Although most of the literature applies funds of knowledge to K-12 schooling with the intention of creating more culturally relevant classrooms, Kiyama (2010) extends this application to university

education in examining how familial knowledge, skills and resources of Mexican American elementary school students informed their educational aspirations for college. This study further extends its application to highly technical graduate STEM degrees.

Social capital includes the formal and informal social networks to which students of color have access through their families or communities. Although Yosso (2005) focuses on the social capital that students bring with them to their educational institutions, this study also investigates the ways in which students acquire additional social capital to amplify their social networks and expand their cultural communities during their undergraduate and graduate degree programs. Through these social networks, students receive moral, emotional, and instrumental support and gain access to additional resources.

Linguistic capital is students' ability to communicate in multiple languages. This study endeavors to understand whether and how these language skills are advantageous to students' accessing, participating, and succeeding in their graduate STEM programs.

Navigational capital, according to Yosso (2005), includes the knowledge and resources that enable students to navigate educational spaces that may be unwelcoming or hostile to communities of color. Although Yosso (2005) focuses on tangible tools or skills that students bring from their family or community cultures to their educational environments, DiNicolo, González, Morales and Romaní (2015) suggest that navigational capital comes in two forms. One form of navigational capital is the tangible knowledge and skills (e.g., bilingual language skills) that students apply in navigating difficult situations for themselves or their families, and the second form is "the knowledge and the strength gained in their families through *consejos*, or advice given in the form of sayings, reminders that are often passed down from generation to generation" (p. 12). DiNicolo et al. (2015)

describe this second form of navigational capital as “support and words of wisdom” from their families and home cultures with which students build resilience that they activate to overcome the challenges that they encounter at school (p. 12). For example, DiNicolò et al. (2015) present excerpts from an elementary school student’s *testimonio* that illustrate how she feels empowered to confront challenges at school because of her mother’s advice. This study focuses on this second form of navigational capital that DiNicolò et al. (2015) identify and explores how the women use their cultural or familial knowledge and values to create agentic perspectives/actions that they employ to overcome the challenges they encounter in their STEM programs.

Although Yosso (2005) provides multiple examples of *resistant capital*, this study focuses primarily on one aspect: “maintaining and passing on the multiple dimensions of community cultural wealth” (p. 80). This study examines the extent to which underrepresented minority and first-generation women graduate students resist following Tinto’s (1988) model of student retention, which requires that they “separate” from their home cultures and communities, learn the values and skills needed to “transition” into the culture of their graduate STEM programs, and fully “integrate” by adopting these new values as their own. Instead, this study highlights the ways in which they remain connected to their individual cultures and communities while persisting in their graduate STEM programs.

Espino (2014) applies Yosso’s (2005, 2006) community cultural wealth to her study that investigates how 33 Mexican-American graduate students use cultural knowledge and skills to both access and persist in their doctoral programs. Espino (2014) illustrates how students use their cultural assets (knowledge, skills, and strategies not valued as traditional

forms of cultural capital) to persist in their graduate degree programs; however, she concedes that “few had the currency to help participants cope with general challenges as well as racism” (p. 565). One such example includes a student being actively discouraged by her advisor from pursuing a PhD and redirected to the more “practice-oriented” EdD, which was perceived to be a better fit (Espino, 2014). Rather than receiving support or encouragement from her institution, the student used her own “resistant capital” to apply to graduate programs and receive fellowships (Espino, 2014, p. 561). Although Espino (2014) suggests that, at times, students’ “marginalized capitals” had “limited capital” during their graduate education, I would argue that these assets were invaluable to students (p. 568). Despite the fact that students’ community cultural wealth was not enough to create transformative institutional change, it provided students with the means to take agentic perspectives and actions in confronting systems of oppression. Furthermore, although Espino (2014) suggests that many of the situations, such as the one described above, could have been resolved with “the restructuring of institutional policies and practices,” she does not describe what these changes should look like or how they should be implemented (p. 568).

Funds of Knowledge

Moll et al. (1992) describe funds of knowledge as “historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being” (p. 133). According to González, Moll, and Amanti (2006), every person’s life experiences give them knowledge; this framework suggests that students come to school with a wealth of knowledge and experiences that other students can learn from. However, most educational institutions do not recognize or reward these

assets. In an effort to make a change, Moll et al. (1992) trained teachers to collaborate with researchers in conducting ethnographic studies of students' households (including observations and interviews) in order to uncover what types of knowledge and skills students (and their families) possessed that could be integrated into classroom curricula and instruction (with the intent of making the curricula more cultural relevant and accessible to students). Moll et al. (1992) suggest funds of knowledge is a unique concept because it includes the "social, economic, and productive activities of a people in a local region not [just] 'culture'...that [they] seek to incorporate strategically into classrooms" (p. 139). Although "funds of knowledge" exists as a separate conceptual framework, Yosso (2005) includes it as part of familial capital and describes how household skills and knowledge are part of a student's familial assets.

In examining the role of funds of knowledge in college aspirations, Kiyama (2010) explains how the values and skills inherited by working-class Mexican American students support their success in school: "The family passed on ideologies established in resilience, perseverance, and hard work – lessons learned from working hard in the fields and translated into working hard in class" (p. 334). In addition to the importance of work ethic, Kiyama (2010) also discusses the ways in which families also share college aspirations with their children albeit in nontraditional ways. One such instance, reported by Kiyama (2010), includes a daughter learning about a specific university from watching college football and playing video games (PlayStation) with her father.

Although Kiyama (2010) describes how this instance reframes the deficit perspective with which education institutions would view the interaction between this parent and child, Yosso's (2005) community cultural wealth provides an even broader

angle to see and understand the knowledge, skills, and values of families and communities of color. Additionally, community cultural wealth goes further than funds of knowledge: the primary purpose of funds of knowledge, in an educational context, is to make connections between household knowledge and skills and the knowledge and skills that schools (and dominant culture) value; however, community cultural wealth provides an alternative way of seeing, knowing, and doing. Both community cultural wealth and funds of knowledge encourage teachers and admissions counselors to view students from an “asset-based perspective.”

Most of the literature using frameworks of community cultural wealth and funds of knowledge apply them to Latino communities/students (Espino, 2014; Kiyama, 2010; Luna & Martinez, 2013; Moll et al., 1992; Vélez-Ibañez & Greenberg, 1992; Yosso, 2005), and most of the literature applies them to K-12 education (Moll et al., 1992; Vélez-Ibañez & Greenberg; Yosso 2005). Additionally, most of the research applies these concepts as two separate frameworks; however, this study departs from that path and includes funds of knowledge as a specific asset of Yosso’s (2005) familial capital. Although this study is not the first to apply community cultural wealth to students in higher education (Huber, 2009a; Luna & Martinez, 2013; Yosso, Smith, Ceja, & Solórzano, 2009) or graduate school (Espino, 2014), it is novel in its application to students in graduate STEM degree programs and to students from a combination of other underrepresented ethnic/racial/socioeconomic backgrounds.

This chapter provided a review of the existing literature that guided the inception of this study and situates it as a counternarrative to the current canon of literature that views

underrepresented minority, first generation, and women in STEM from a deficit perspective. The next chapter will provide an overview of this study's methodology.

CHAPTER THREE: METHODOLOGY

Introduction

This chapter provides an overview of the methodology used to conduct the study. It begins with an explanation of why a quantitative methodology was not sufficient to adequately answer the research questions and why a qualitative methodology was the logical choice. The chapter provides justification for the specific approach-a critical ethnography-and describes the sample population as well as explains the methods used (*testimonios*, a focus group, and observations of nonverbal communication during interviews and the focus group session) in data collection. In addition, this chapter also describes the process for analyzing the data. The instruments for this study are included as appendices.

It follows that in order to interpret and understand the situation of a particular group of people, thought has to start from their lives. Essentially, standpoint feminist epistemology urges us to move away from the idea of simply adding the “other” to preexisting frameworks and directs us to ground knowledge on the particular experience of the people we want to understand. (Lorde, 1984, p. 144)

Lorde’s (1984) quote is particularly relevant to this study’s research questions, which investigate what individual and institutional characteristics might contribute to underrepresented minority and first-generation women graduate students’ success in STEM programs. Because these questions seek to reconceptualize what individual and institutional assets promote success rather than simply incorporating the “other” into preexisting definitions, the research methodology chosen must provide an opportunity for the research subjects to share their experiences and provide counternarratives to existing literature.

Much of the existing research on underrepresented minorities and/or female students in STEM majors is quantitative in nature (Hill, Corbett, & St. Rose, 2010; Huang, Taddese, & Walter, 2000). Although findings from quantitative research have provided a foundation that is useful for determining the scope of this research question (e.g., the number of female underrepresented minority students in STEM fields and the extent to which their participation, retention, achievement, and completion rates are similar to and different from other women and their male counterparts), these findings alone do not go far enough to question prevailing concepts of favorable individual student characteristics, which are often synonymous with whiteness. The application of McIntosh's (1989) concept of "white privilege" explains how white students' knowledge, characteristics, experiences, and values are not universal; however, education systems, institutions, and curriculums render their position of unquestioned privilege as the norm. Consequently, university policies and practices that do not consider the diversity of students' identities, experiences, or differentiated needs disregard or exclude (whether intentionally or unintentionally) the students who do not fit within this archetype.

In referencing Sax's (2008) analysis of eight million college students' responses to two nationally representative surveys related to college experience, Ropers-Huilman and Winters (2011) contend: "Many educational approaches commonly associated with student success, may, in fact, have opposite effects for women and men" (p. 667). In other words, because student experiences in higher education are gendered, Ropers-Huilman and Winters (2011) suggest the need for policy and practices designed to address students' differentiated needs. In her research, Sax (2008) finds male and female students' educational experiences including connections with their families, relationships with

faculty members, study habits, choice of major, and self-efficacy differ, and require various types of interventions to support their success. This quantitative research shows the differences between males and females' experiences in higher education; however, it does not provide rich details about the manifestations of these differences or offer explanations for why these differences exist. Therefore, quantitative methods, "the master's tools," cannot alone dismantle the current understandings of students' experiences, concepts of favorable individual characteristics, or facilitate genuine change for students because higher education system policies and practices neither recognize these students' assets nor assist them in capitalizing upon them through, what Pidgeon (2008) refers to as, "counter-hegemonic points of view of educational success" and thus set them up failure in STEM majors (p.340).

Although Bensimon and Marshall (2003) focus on the merits of feminist critical policy analysis in general rather than its application to education specifically, their discussion on the use of a critical feminist framework is relevant to investigate how first-generation, low-income racial and ethnic minority female students' individual characteristics interact with their universities' institutional characteristics to encourage or discourage academic success in STEM disciplines in general and specifically in computer science, engineering, astronomy, and environmental chemistry. In analyzing faculty productivity, Bensimon and Marshall (2003) note how men typically become the benchmark and point of comparison for women faculty members; however, by employing a feminist conceptual framework, researchers can reframe questions: rather than asking "Why are women faculty less productive than male faculty?" researchers can ask "In what ways does 'gender' impact productivity?" (p. 345). By reframing research questions related

to underrepresented minority and first generation graduate students, this study centers on what factors contribute to these students' success in STEM majors.

Kinzie (2007) refers to this refocusing as “an example of seeing the familiar differently” (p. 89). In her reflections about previous research on women in STEM education, she explains how feminist frameworks provide more focused lenses with which to examine gender equity issues in STEM fields. Kinzie (2007) explains that while the statistics of quantitative research can highlight trends and indicate progress in women's access to and participation in STEM education, “they mislead us into thinking that equity in science is simply a matter of adding women into the science talent pool” (p. 89). Furthermore, Kinzie (2007) contends that statistics cannot offer insight into the complex and multifarious experiences that women have in STEM fields and educational programs: these experiences are “shaped by systems of inequity such as classism, racism, and sexism” that are difficult to capture with quantitative data (Kinzie, 2007, p. 89). These limitations, according to Kinzie (2007), suggest that quantitative measures of parity alone are unable to provide any meaningful indication about the state of gender equity in STEM.

For this reason, Ropers-Huilman and Winters (2011) posit that a feminist research framework in combination with qualitative research tools will illustrate gendered experiences in higher education. They write:

Feminist research is sensitive to context and participants, attempting to adapt and adopt methods that ensure an understanding of the gendered experiences within social institutions. This focus promotes the complex two-pronged goal of understanding and change within sociopolitical contexts. It can both deconstruct and inform policy decisions that directly or indirectly affect gendered experiences in postsecondary education institutions. (Ropers-Huilman & Winters, 2011, p. 685)

With the strengths of this research in mind, Ropers-Huilman and Winters (2011) advocate for the incorporation of qualitative research methods, including story-telling, self-

reflexivity, dialogue and other qualitative methods into higher education, which they suggest will encourage a “move toward a social justice in educational research practice” (p. 684).

Social justice, Creswell (2003) and Mertens (2015) contend, is a guiding value that informs the design of critical qualitative research studies, which seek to investigate and challenge social issues, such as power imbalances, inequities, and injustices. While quantitative methodology has documented measurable differences between male and female students’ experiences in STEM fields, it cannot explain how or why their experiences are different, a limitation that fits within the issue of inequality, as outlined by Creswell. For these reasons, qualitative methodology is more appropriate to address the research questions.

Qualitative Methods

Qualitative methods are particularly well-positioned to answer research questions that seek to explain what, how, and/or why (Creswell, 2007; Mertens, 2015; Yin, 2009). The purpose of this research seeks to understand both the what and the how of socially constructed realities: *how* should the concepts of individual and institutional assets be redefined; *what* are the relationships between individual and institutional characteristics; *how* do these characteristics as well as the relationship between them differ among women STEM students; and to *what extent* do these characteristics support women students achieving success in STEM majors.

Creswell (2003) highlights two types of knowledge claims in qualitative research: constructivist and emancipatory. Constructivist research, according to Mertens (2015), acknowledges that “reality is socially constructed” and further contends there is no one

“objective reality” (p. 18). Rather, these researchers attempt to examine the multiple realities that are created by and reflected in social interactions. In this case, the multiple realities being investigated are those of women STEM students in the fields of computer science, aerospace engineering, electrical engineering, astronomy, and applied environmental chemistry. Methods such as observation, interviewing, and document analysis are typical means of investigation in constructivist ethnographic research (Mertens, 2015).

Observations are also particularly important in ethnographic research because researchers can observe participants in a natural setting in order to understand how participants make sense of their lived realities (Mertens, 2015). Even this study’s limited observations of the women participants’ nonverbal interactions and reactions during the interviews and focus group session provide additional insight into their perspectives on the individual and institutional factors that support their success.

According to Mertens (2015) open-ended interviewing as a method in qualitative research with a constructivist/interpretive ethnographic design is “hermeneutical” and describes contextual factors whereas in the transformative paradigm (or research with emancipatory assumptions), the focus, according to Mertens (2015) is on the “dialogic” (pp. 11-12). Dialogue is especially important to this study in which the focus is not only to gain in-depth understanding of women’s experiences in STEM majors but also to critically analyze the policies and practices that perpetuate gender inequity.

In addition, previous research has demonstrated that qualitative research is especially relevant to feminist perspectives (Bailey, 2012; Mertens, 2015; Olesen, 2011), immigrant groups (Dodson, Piatelli, & Schmalzbauer, 2007; Mertens, 2015), and minority

populations (Leong, 2012; Mertens, 2015) because it not only provides these frequently marginalized populations with a voice and a platform for sharing their thoughts but also allows the researcher to gain a better understanding of the complex interaction of factors that constitute people's identities and social realities. The subjects of this research study include students from all of the above-mentioned categories, as well as students with overlapping and intersecting identities (wherein a student self-identifies with more than one of the categories above); in this regard, a qualitative methodology is a logical choice. Furthermore, previous education research on these populations (Benmayor, 2002; Espino, 2014; Espinoza-Herald, 2007; Moll et al., 1992; Tate & Lin, 2005) has used a qualitative methodology in seeking to understand students' experiences in education, so the continued application of qualitative research methods would build on their research findings.

Testimonios: A Tradition and Its Evolution

In contemporary postmodern discourse, these concealed, marginalized elements are usually referred to as "alterity," "other," or "otherness." But "the other does not exist," to paraphrase Jacques Lacan's (1983, 144) notorious statement: "There is no such thing as The woman," where the definite article stands for the universal. There is no such thing as The woman since of her essence . . . she is not at all." (Yúdice 1991, p. 22)

The quote above highlights the fact that women are not a monolithic group and that no universal women's experience exists. Although literature has been written on women's experiences and the gender bias that they encounter in STEM academic disciplines and fields of work, Williams, Phillips, and Hall (2014) explain that more research is necessary because "the current body of social psychological work on gender bias has focused almost exclusively on the experiences of White women" (p.4). Furthermore, the work that has been written on women of color in STEM highlights their "otherness" from both white

women and men instead of focusing on sharing the variance in women's unique identities, assets, and challenges, which constitute women's collective experiences in STEM.

Testimonios, as a preferred methodology, emerged out of resistance to this lack of inclusion of other voices, experiences, narratives, and knowledge and functions as a counternarrative to mainstream, privileged discourse. *Testimonios* have been used to provide alternative accounts to written history, or a more personalized account of events that have taken place by people who have been affected. These accounts are not just given by witnesses to monumental events; rather, they are accounts of social actors who have had lived experiences and who have taken agentic perspectives or actions but may not have received recognition for them in documented or preserved historical accounts. Cruz (2012) explains that *testimonios* typically present the account of someone who “has experienced or witnessed great trauma, oppression, forced migration, or violence, or of a subject who has participated in a political movement for social justice” (p. 461). In their reflections on the findings of Cruz's work with homeless youth, López and Davalos (2009) highlight another important characteristic of *testimonios*: they are “perhaps the most vital means by which to gain access to information otherwise not available” (pp. 17-18).

Testimonio in the Latin American tradition. Various styles of *testimonios* exist: in some, one voice serves as an autobiographical account to represent collective oppression: in others, multiple voices provide their unique accounts of a collective experience. In one of the most seminal examples of *testimonio*, Burgos-Debray (1984) interviewed a 23-year-old Guatemalan indigenous woman, Rigoberta Menchú, over the course of several days and then transcribed and published her story. Although the account is autobiographical in nature, Menchú suggests it is more collective than it is individual in

the way that it serves as an indigenous counternarrative to Guatemalan history. She indicates her plan to share her personal story as a testimonial to the collective struggle that the indigenous Guatemalans faced in stating:

My name is Rigoberta Menchú. I am twenty three years old. This is my testimony. I didn't learn it from a book and I didn't learn it alone. I'd like to stress that it's not only my life, it's also the testimony of my people.... The important thing is that what has happened to me has happened to many other people too: My story is the story of all poor Guatemalans. My personal experience is the reality of a whole people. (1984, p. 1)

Another individual as collective *testimonio* is *Let Me Speak! Testimony of Domitila, a Woman of the Bolivian* mines in which Domitila Barrios Chungara, a Bolivian activist, wife of a miner, and mother to seven children, shares her personal *testimonio* about her experience in the collective class struggle of Bolivian workers. The following excerpt from Viezzer's (1978) introductory "To the Reader" explains how Chungara's individual *testimonio* is part of the larger collective experience of her *compañeros*:

Together with sisters, she lives directly the defeats and the victories of the people. And from this experience she interprets reality. Everything she says is life and projection. ... Nothing of what appears here is alien to Bolivia's reality, because Domitila's personal itinerary is a part of the great march of the Bolivian working class and people. (Viezzer, 1978, pp. 9-10)

Chungara's *testimonio* is different from Menchú's in that it comes not only from multiple interviews with Moema Viezzer, but also from speeches that she made at the United Nations International Women's Year Tribunal, radio and television appearances, written correspondence, and conversations with others (Viezzer, 1978). Viezzer (1978) gathered the above-mentioned sources and then worked with Chungara to organize and present them in the book. Working with Chungara provided Viezzer (1978) with an opportunity to confirm that the organization of the material both captures and offers readers an authentic view of Chungara's life experiences.

López and Davalos (2009) explain “the distinction of the *testimonio* as a genre is that individual stories place communal struggle at the center of their understanding of the world. The *testimonio* is, therefore, a discourse that simultaneously engages and performs the personal and collective aspects of identity formation” (p. 18). Yúdice (1991) expands on the idea that *testimonios* are simultaneously individual and collective noting that “... testimonial writing, as the word indicates, promotes expression of personal experience. That personal experience, of course, is the collective struggle against oppression from oligarchy, military, and transnational capital” (Yúdice, 1991, p. 26). In sharing personal experiences, *testimonios* like Menchú’s and Chungara’s provide a window for readers not only to see but also understand others’ lived realities, such as the experiences of indigenous Guatemalans in the case of Menchú’s testimony and working-class Bolivians in the case of Chungara, which are often overlooked by historians. Arcilla (2008) suggests the individual as collective approach, which is characteristic of *testimonios*, provides a social justice lens with which to see and understand the experience presented: “while the story teller shares her story, her story is also the story of a social class struggling for social justice and human rights. It is the narrative of a person struggling, moving with other marginalized for social change” (Arcilla, 2008, p.110). This social justice aspect or the connection to a larger struggle of oppression and desired social change is what differentiates the *testimonio* from an autobiography (Arcilla, 2008).

Testimonios are often used as a qualitative research method in Latin American, and particularly Latin American feminist, studies and scholarship (Arcilla, 2008; Espino, Vega, Rendón, Ranero, & Muñiz, 2012; Huber 2009a; The Latina Feminist Group, 2001). Huber (2009b) suggests “there is no universal definition of *testimonio*”; however, certain

elements differentiate *testimonio* from other qualitative methods or data (p. 643). These elements, according to de Saxe (2012), include the fact that *testimonios* should incorporate the voice(s) of the marginalized without essentializing or generalizing, should foster solidarity between the speaker(s) and reader(s), and encourage both social change and social justice. Arcilla (2008) notes that this method also requires “repeated interview/story telling sessions” that constitute “a seriously appropriate form to recognize, listen and understand the silenced voice of the subaltern in the reconstruction of history” (p. 116). Huber (2009b) suggests that *testimonio* as a research method is well-suited for this kind of social justice-oriented research in noting: “[a] *testimonio* can contribute to the growing scholarship on critical race methodologies which seeks to disrupt the apartheid of knowledge in academia, moving toward educational research guided by racial and social justice for Communities of Color” (Huber, 2009b, p. 640). However, she also cautions researchers about the potential cooptation of *testimonio* in writing: “*Testimonio* should not function as a tool for elite academics to ‘diversify’ their research agendas or document their personal stories” (Huber, 2009b, p.650).

Testimonio in the Spanish tradition. In the American education tradition, much of the work on testimonios has focused on Latina/Chicana critical pedagogy (Cruz, 2012; Delgado Bernal, Burciaga & Flores Carmona, 2012; Nava & Lara, 2016). *Testimonios* also exist in other contexts: they document Holocaust survivors’ stories (Gurewitsch, 1998; Rittner & Roth, 1993; Waxman, 2003), Dalit women’s stories (Bama, 2000; Rege, 2006) and Kashmiri widowed and “half-widowed” women’s stories (Rashid, 2011; Vohra, 2016). However, *testimonio* originated during the European colonization of the Americas. D’Olwer’s (2012) *Cronistas de las culturas precolombinas* presents an anthology of

testimonios from the European explorers and conquerors of the new world that document their journeys, discoveries of lands, and perceptions of indigenous cultures. While most of the explorers (including Columbus) simply wrote letters and journal entries to provide first-hand accounts of their discoveries to the European monarchs who were funding their expeditions, Escalante Gonzalbo (2012) contends, in his introduction to the anthology, that other explorers interjected more critical elements into their ethnographic accounts of the indigenous populations, such as bearing witness to and empathizing with the pain and suffering that the native populations experienced as a result of colonization.

Although Escalante Gonzalbo (2012) suggests that some of the conquerors' *testimonios* documented and reflected on the common humanity that they shared with the indigenous populations, Bartolomé de Las Casas openly criticized the practices of colonization and advocated for greater respect and rights for the native populations. Casas, a Dominican friar and the first bishop of Chiapas, Mexico, expanded the European explorers' use of *testimonio* with the publication of *Brevísima relación de la destrucción de las Indias* (*A Short Account of the Destruction of the Indies*), which highlighted his reflective inquiry into the Spanish colonizers' inhumane treatment of the indigenous population in the Americas. Prior to publishing his *testimonio* in 1552, Casas presented it to the Spanish court in an attempt to persuade them to reform their policies and practices with the indigenous population; after its publication, it was widely distributed (Simonsen, 2013). While Casas' *testimonios* were first-hand accounts that documented the Native Americans' experiences, they were still written in his voice (and not the voice of the indigenous people); however, his *testimonios* did document the injustices that he witnessed and advocated for social change.

This discussion not only shows that Chicana/Latina scholars did not invent the term *testimonio* but also describes the evolution of its usage. While *testimonios* in the American education tradition emerged from Chicana/Latina critical pedagogy, other feminist researchers have used *testimonios* to document marginalized women's voices and their previously overlooked experiences with the intention of engendering social change. In her analysis of Català's (1984) *De la resistencia y la deportación: 50 testimonios de mujeres españolas*, which presents 50 *testimonios* of Spanish women's experiences during the Holocaust, Hintz (2000) argues in support of Catalá's (1984) use of *testimonio* in writing: "There are those critics who feel that testimonio is the literature of the Third World; still others think that it is the autobiography of the illiterate. The Third World and the illiterate are not the only marginalized members of the world's society" (p. 23). Hintz (2000) suggests that the 50 *testimonios* presented by Catalá (1984) show the united plight of Spanish women in the Resistance Movement through the diversity of their experiences: approximately half of the *testimonios* are from women who were arrested and imprisoned in concentration camps while the other half are from women were members of the Resistance Movements in France. In addition, men wrote three of the *testimonios* about women, and one woman wrote her *testimonio* in a letter in which she discussed witnessing her husband's activities in the Resistance Movement. Although all of the *testimonios* document each of the women's individual experiences, Hintz (2000) contends that together they tell a collective experience of Spanish women in the Holocaust that is primarily undocumented in official history texts. Catalá's (1984) book, according to Hintz (2000), not only provides "an opportunity for emotional catharsis" through the documentation of each *testimonio* but also enables women (including Catalá herself) to create a collective

counternarrative with their previously untold stories, which caution readers to prevent history from ever repeating itself (p. 33).

Testimonio in other contexts. Rege (2006) and Bama (2000) also present *testimonios* that chronicle women's lived experiences that would otherwise go undocumented. The Dalit Indian women's *testimonios* that appear in Rege (2006) and Bama (2000) are women who share their own stories, which are fraught with injustices and inequities. In addition to documenting their oppression, their counternarratives serve as resistance to the discriminatory depictions in which they (Dalit women) are portrayed within the deeply entrenched and hierarchical caste system. Thomas (2016) explains how Dalit women are oppressed by both the caste system and patriarchy, and their voices and experiences are largely unaccounted for in both the Dalit movement, which is dominated by men, and the Indian feminist movement, which is led by women of higher castes and classes. Nair (2008) defends Rege's (2006) use of the term *testimonio* and suggests that *testimonios* provide a new intersectional lens with which to specifically view Dalit women's issues in India.

Rege (2006) is not the first to use the term *testimonio* to describe the writing of a Dalit woman. Nayar (2006) also categorizes Bama's (2000) autobiographical *Karukku* as a *testimonio* in arguing that her writing presents a collective experience and requires readers to bear witness to the injustices that Dalit women, and particularly Dalit Christian women, experience in India. Nayar (2006) explains how Bama (2000) presents *Karukku* as a collective experience through her use of the pronouns "we" and "our" instead of the singular first person throughout her writing. In supporting her justification for categorizing

Karukku as *testimonio*, Nayar (2006) also presents evidence from Bama's (2000) own descriptions of her autobiography during an interview in which she said:

The story told in *Karukku* was not my story alone. It was the depiction of a collective trauma – of my community – whose length cannot be measured in time. I just tried to freeze it forever in one book so that there will be something physical to remind people of the atrocities committed on a section of the society for ages. (Bama, 2000 as cited in Nayar, 2006, p. 84)

This description of *Karukku* is reminiscent of the opening pages of both Rigoberta Menchú and Domitila Barrios Chungara's classic *testimonios* in which both authors explain how their individual stories represent the collective experience of women in their Latin American communities. Menchú states, "My personal experience is the reality of a whole people" (Burgos-DeBray, 1984, p.1). Similarly, Viezzer (1978) indicates that "Domitila's personal itinerary is a part of the great march of the Bolivian working class and people" (p. 9-10). The style of Bama (2000) is consistent with the individual as collective *testimonio*, as described by Maier (2004), in which someone with the authority to speak for their collective (We) replaces the individual subject (I).

Testimonio in the Indian tradition has also included Kashmiri Muslim women. Rashid (2011) exposes the discrimination that they experience as widows and "half widows" and provides a counternarrative to their community's perception of them. Rashid (2011) presents the experiences of both Kashmiri Muslim women widows after the deaths of their husbands and "half widows" after the disappearance of their husbands in their own voices. Rashid (2011) explains how women who are "half-widows" are unable receive economic benefits or attain property rights without a death certificate for their husbands. In addition to discussing the economic pressures, Rashid (2011) highlights the women's descriptions of religious and social pressures that discourage them from remarrying. Vohra

(2016) describes Rashid's (2011) book with the term *testimonio* and lauds her success in providing the women an opportunity for catharsis through the documentation of the discrimination against them and with the development of their own counternarrative. Vohra (2016) contends that the women's *testimonios* serve as their resistance to the multiple forms of oppression that they experience and enable them to create an alternative discourse that contributes both to their individual healing and to initiating social change.

Nanquette (2014) also references the personal and political aspects of *testimonio* in her discussion of the Iranian refugee experience in Australia: the refugees' *testimonios* are both an account of one person's experience (female OR male) and a collective representation of all Iranian asylum seekers in who fled violence and persecution in Iran and encountered traumatic experiences upon their arrival at detention centers in Australia. The *testimonios* bear witness to both the struggles that the refugees have experienced and the resilience they have shown and encourage a call to action to improve the Australian government's treatment of all asylum seekers. While Nanquette (2014) focuses on the more recently documented Iranian experience, she indicates that Afghani and Iraqi *testimonios* existed prior and also provide accounts of both women and men refugees' experiences in Australia with the intention of documenting ongoing issues and improving the process for all.

Although Latina and Chicana scholars are leaders in their application and use of *testimonio* in both American education and feminist writing, the examples from Australia, India, and Spain show that no monopoly exists on theory, methodology, or terminology. These multicultural examples illustrate the ways in which women all over the world have used *testimonio* as a means to document both individual and collective experiences of

marginalization. Through the documentation of their experiences, they exercise agency in using their own voices to write counternarratives to the official dialogue (or lack of dialogue entirely) about the social and political injustices that they experience.

The evolution and expansion of *testimonio*. The evolution of *testimonio* is similar to the way in which critical race theory has expanded to include other marginalized communities of color and confront the discrimination that they face not only legally, but also in education, employment, housing, and healthcare. Emerging from critical legal studies, critical race theory analyzes both the concepts of race and racism in a legal perspective to argue that although laws suggest that equality and meritocracy exist, this rhetoric reflects idealized visions of color blindness rather than actual circumstances of racial oppression. In other words, the law and the American legal system are not neutral but rather, serve to protect and uphold the rights of white citizens and contribute to the perpetuation of racial inequity (Crenshaw, 1995). Scholars have also applied critical race theory to education to suggest that education curriculum, evaluation, institutions, and systems are not neutral because they were designed by and are reflective of white interests. Because marginalization exists beyond the color binary (white-black), Yosso, Villalpando, Bernal, and Solórzano (2001) explain how other branches of critical race theory have emerged to analyze and address discrimination that other communities of color face; these branches include Latino critical race theory (LatCrits), feminist critical race theory (FemCrits), Asian critical race theory (AsianCrits), tribal critical race theory (TribalCrits), and even white critical race theory (WhiteCrits), which exposes and critically examines the concept of white privilege. These offshoots of critical race theory provide various examples of the ways in which the broadening of conceptual frameworks occur.

In justifying the broadening of the use of *testimonio* as a method for my dissertation, it is important to note that this study is not my personal story; rather, I bear witness to and help facilitate the women's participatory knowledge production. This study provides women graduate students of color in STEM disciplines with a space to share their experiences and an opportunity to interrupt the deficit discourse surrounding their participation (or lack thereof) in their graduate programs. In questioning what method(s) would allow me as a researcher to collect and present the detailed information needed to fully understand these women's experiences, I found an answer in Huber's (2009b) description of *testimonio* in which she states: "This is the power of *testimonio* – to connect human beings in ways that enable us to bear witness to experiences and struggles of those beyond our own realities" (p.648-649).

The need for *testimonios* became apparent to me after conducting the first three of the initial semi-structured interviews with participants: coded themes and snippets of quotes could not do justice to the experiences that these women have had or sufficiently illustrate the various assets they bring to their programs and fields of study. After the first three interviews, two of which were over an hour and a half in duration, I recognized that the information that these women shared during our conversations and their subsequent follow-up contacts with me, which they initiated either to add to or reflect on topics discussed, provided much more than simple responses to interview questions. The best way to describe the data that the women provided reflects Barragan's (2014) criteria for *testimonio*: each woman spoke in first person about their individual experiences of marginalization in higher education and both collectively identified as being from a marginalized background and possessed a compelling desire to change their own

experiences and those of future women scholars from similar backgrounds. I agree with Armstrong's (2010) observation about the ability of *testimonio* to connect people and experiences and suggest that this trait is particularly relevant to and reflected in this study. Armstrong (2010) writes, "Testimonios bridge different histories and origins, building cross cultural coalitions and personal relationships. It is also a site of intersection of ethnicity, nationality, race, class, gender, sexuality, age and other markers of diverse identities and communities" (p. 4). I felt that *testimonio*, which frames the individual's experiences within a collective history of marginalization and encourages solidarity, would be an apropos means of connecting these women's experiences in and criticisms of higher education. Although the women self-identify with different ethnic and racial backgrounds, the presentation of their experiences through *testimonio* highlights the connection that they share in encountering marginalization within their university classrooms and campus and their common desire to create change while simultaneously allowing me to explore my research questions in depth and complexity.

Yúdice (1991) explains how alternative personal experiences serve as the basis of *testimonio* writing and suggests: "The rejection of the master narrative thus implies a different subject of discourse, one that does not conceive of itself as universal and as searching for universal truth but, rather, as seeking emancipation and survival" (pp. 16-17). Similar to the way in which Menchú and Chungara attempt to provide refocused counternarratives to the presentation of historical events involving marginalized populations, this study attempts to re-conceptualize the discussion on women who self-identify as underrepresented minority and first generation graduate students in STEM disciplines: by sharing their stories and experiences, this study shows that although no one

universal alternative master narrative exists, together all of these testimonials constitute a collective of both individually nuanced and shared counternarratives.

In writing about the use of women's testimonials from the Holocaust, Waxman (2003) provides a contextual example that shows how multiple, distinct, individual counternarratives create a collection of counternarratives that serves as an alternative understanding or vision. I discuss Waxman's (2003) article as an example that shows why the inclusion of multiple counternarratives is so important: in her article, Waxman (2003) explains how different voices often provide distinct perspectives on the same event or experience. Waxman (2003) describes how mothers in concentration camps took very different agentic perspectives and actions, which they all justified as a means of protecting their children. For example, Waxman (2003) notes that some pregnant women in the concentration camps hid their babies and fed them sugar water to save them at all costs while other mothers suffocated their newborns to prevent them from suffering either a horrible and cruel life in a concentration camp or a certain painful death. While Waxman (2003) acknowledges the diverse counternarratives that women's testimonials offer, she contends that only women's stories that "are seen as suitable or palatable for their readers" are given preference while "often avoiding those that do not accord with expected women's behavior or pre-existing narratives of survival" (p. 662). In defending her logic for presenting a diverse collection of women's *testimonios*, Waxman (2003) writes:

This article focuses on the testimonies of women, not because it is they who are normally excluded from history, but because it is women whose experiences are chiefly controlled by rigid ideas about patterns of suitable behaviour. It is important to show that the categories of meaning usually employed to make sense of the world can hide many layers of understanding. (p. 663)

This quote from Waxman's (2003) article suggests that the documentation of women's stories is often regulated by social and gender norms, which diminishes the complexity of their collective experiences.

The regulation of different perspectives is one of the topics that Beverley (2008) discusses in addressing Stoll's (1999) criticisms of Menchú's *testimonio*. Scholars contend that Stoll's (1999) book attempts to discredit more than the details of Nobel Prize winner Menchú's *testimonio* (Gugelberger, 1999; Stanford, 1999; Smith, 1999). Through what Smith (1999) might call "ad hominem arguments," Stoll (1999) attacks Menchú's *testimonio* with the intention of showing how the leftist movement in Guatemala (to which Menchú belongs) deceived international audiences into believing their depiction of the Guatemalan Civil War, which portrays the poor indigenous population as victims of genocide who only resorted to violence in response to the army's use of state terror against them (p. 82). Stoll (1999) refutes claims made in Menchú's *testimonio* about the actual circumstances of events described (e.g., the deaths of her brother and father, her educational attainment, the amount of time that she worked in agricultural labor, the identity of the opposing party in her family's land dispute, etc.) and argues that even if these discrepancies are insignificant they indicate a more serious issue: the questionable trustworthiness of Menchú (specifically) and the genre of *testimonio* (in general) in providing a credible alternative discourse.

Beverley (2004) contends that Stoll (1999) questions the facts and events in Menchú's *testimonio* not to contest the authenticity of them but rather to suggest that someone else is better suited to document them. Although he acknowledges the existence of multiple perspectives or agendas, Beverley (2008) suggests that Stoll (1999) would

subject them to assessments conducted by an “outside observer (the ethnographer or social scientist) who is alone in the position of being able to both hear and sort through all the various conflicting accounts” (p. 578). The problem with this understanding of *testimonio*, according to Beverley (2008), is that it removes the agency of the person giving the *testimonio* and wrongfully redistributes it to researchers who have “institutionally sanctioned authority and pretended objectivity as intellectuals, which give [them] the power to decide what counts in the narrator’s raw material” (p. 579). For Beverley (2008) this process is essentially akin to “resubalternizing” Menchú and her counternarrative (p. 590). Beverley (2008) explains Menchú’s purpose of giving a *testimonio* is not to provide an objective truth or “toda la realidad” but rather to artfully (re)present the experiences and interests of her community, which, for Beverley (2008), is the essence of *testimonio* (p. 579). While Beverley (2008) recognizes the distinct style and purpose of *testimonio*, he acknowledges that academics like Stoll (1999) struggle to both comprehend and accept *testimonio* as an alternative but equally scholarly form of discourse or documentation. For Beverley (2008), this agitation reflects the strength of *testimonio*: in other words, “the force of a testimonio such as *I, Rigoberta Menchú* is to displace the centrality of intellectuals and what they recognize as culture – including history, literature, journalism, and ethnographic writing (Beverley, 2008, p. 579).

Similar to the ways in which *I, Rigoberta Menchú* re-conceptualizes what counts as history, literature, and/or ethnographic writing, the *testimonios* gathered for this research also re-conceptualize what cultural traits or practices count as positive assets that contribute to students’ success in their STEM disciplines; and in doing so, these *testimonios* encourage the researcher and institutions of higher education to reevaluate what individual

and cultural assets are valuable and warrant validation. Furthermore, the alternative perspectives presented in the women's *testimonios* suggest the need to reexamine official narratives about the types and utility of support available to underrepresented minorities, women, and first-generation college students in STEM disciplines.

Testimonios are a good mode for re-envisioning this understanding because, as counternarratives, they provide researchers with an opportunity to gain insight into other experiences and alternative perspectives. Beverley (2008) explains how Stoll (1999) critiques Menchú's *testimonio* for not neatly aligning with documented information collected by established research methods; however, Beverley (2008) contends that Stoll (1999) is forgetting the purpose of *testimonios* like Menchú's, which is to provide a platform for previously excluded voices and gain insight into the experiences that have been neglected by the dominant narrative. Rather than serving as a subject in Stoll's (1999) work, Beverley (2008) suggests that Menchú is an active participant in producing her account because she "has [her own] agenda" and, therefore, "function[s] in her narrative as an organic intellectual, concerned with producing a text of local history" (p. 576).

I share the *testimonios* given by the women who self-identify as underrepresented minority and first generation graduate students in STEM disciplines, not to support my own predetermined reconceptualization of individual and institutional factors that support students' success in STEM, but so that they, like Menchú, and Chungara, can offer their own counternarratives that portray their understanding of the experiences that women have in STEM disciplines as well as the factors that have supported their success.

Testimonio and feminist standpoint theory. The application of de Saxe (2012) provides justification for the use of *testimonios* in critical feminist education research

guided by feminist standpoint theory in noting: “When educators consider the first component of conceptualizing critical feminist theory as a way to think about disrupting the canon, one might use narratives as a method for recognizing or fighting oppression” (p. 196). In referencing examples of *testimonios*, de Saxe (2012) explains how the counternarratives that emerge from *testimonios* “refram[e]” conversations and show how certain theories or bodies of knowledge remain unchallenged and are reproduced both within academia and by academics (p. 196). Because feminist standpoint theory suggests that knowledge is socially constructed, marginalized groups are better equipped to question the status quo than their non-marginalized counterparts, and discussions about power relations should emerge from the voices of marginalized groups (Bowell, n.d.). For feminist standpoint theorists, gender is a point of difference in experiences and views. Researchers applying feminist standpoint theory approach their research questions from the perspective of women; but, at the same time, they seek to understand how women’s experiences are both distinct from men’s and from other women’s depending on their differentiated standpoints (e.g., race, ethnicity, socioeconomic status, etc.).

Other scholars have applied feminist standpoint theory to investigate the role of gender in science (Campbell, 2009; Harding, 2004; Wylie, 2003). They argue that science is socially constructed and has left out the voices of marginalized populations, specifically female voices. Women who self-identify as underrepresented minority and first generation graduate students in STEM are both insiders and outsiders in their fields of study: although they are graduate students who have completed a bachelor’s degree in their discipline; they are also members of marginalized racial or ethnic minority groups within their fields of study. Therefore, they not only possess an understanding of how their institutions and their

specific academic fields of study either support or hinder students who are marginalized as a result of their gender, race/ethnicity, or first-generation status, but also occupy positions that enable them to critically question campus policies, practices, and culture in their *testimonios*. Salvádar-Hull's (2005) discussion on The Latina Feminist Group's *Telling to Live* describes the ways in which *testimonios* allow marginalized women to provide counternarratives that more accurately depict their experiences in U.S. higher education institutions when she writes: "Their testimony attests to the urgency with which U.S. women of color struggle for a voice, for visibility..., and for survival in their journey through the formidable class system and white privilege in U.S. institutions of higher education" (p. 334). *Testimonio* provides marginalized women with the opportunity to share their unique experiences that form a collective counternarrative to mainstream conversations on minority women in STEM fields.

Creating collaborative counternarratives. In writing their counternarrative on the Latina identity in the United States, the Latina Feminist Group (2001) re-conceptualized the process of testimonial writing. The women academics created small discussion groups in which they reflected on their reasons for pursuing careers in academia and whether their experiences have met their expectations. Then, they convened with larger groups to examine emerging themes and engage in deeper probing questions. The Latina Feminist Group (2001) contends this methodology goes beyond other feminist qualitative methodologies because participants are "not speaking from the voice of the singular 'I'. Rather, [they] are exploring the ways in which [their] individual identities express the complexities of [their] communities as a whole" (p. 20-21).

Espino et al.'s (2012) study builds upon the work of the Latina Feminist Group (2001) in investigating the experiences of Latina women scholars in the academy. In this study, four emerging Latina scholars each shared their *testimonios* with an experienced Latina scholar who then reflected on and responded to the *testimonio* given. Espino et al. (2012) suggest that these dialogue partners helped to uncover the women's "collective consciousness" that is informed by the "core values that we [they] share that are rooted in our [their] *Latinidad*, as well as the complexities of our [their] multiple identities (p. 449). Although their experiences were each unique, common elements existed among all of the *testimonios*, which the authors suggest they, "as members of multiple marginalized groups" in academe share (Espino et al., 2012, p. 454). Espino et al. (2012) attribute the development of the collective consciousness to this dialogic process, which they term *reflexión*: they explain how it "provided a sense of wholeness as we [they] affirmed that we [they] were not alone in our [their] journeys.... The middle place where *testimonio* and *reflexión* meet is the spiritual place of identity; it is the place where two consciousnesses meet to create a collective consciousness" (p. 455). The collective consciousness that they constructed included not only shared struggles but also shared resistance and a shared sense of empowerment, which resulted from them disclosing vulnerabilities, validating experiences, and offering wisdom and encouragement to each other during this dialogic process.

Instead of focusing on a singular experience or a particular cultural identity or asset of women in STEM graduate programs (or women from marginalized backgrounds in STEM graduate programs), this study examines the similarities, differences, and nuances among all experiences and assets described by underrepresented racial and ethnic minority women

graduate student participants. And in making the *testimonio* “democratic,” according to Arcilla (2008), the researcher must recognize her own social position and privilege without imposing it (p. 125). The acknowledgement of privilege does not necessitate disregarding the participatory research process. Rather, it helps to define the unique roles of the person giving the *testimonio* and the researcher. In explaining this delineation, Arcilla (2008) contends, “the engaged *testimonio* extracts the practical knowledge of the subaltern and uses the theoretical knowledge of the intellectual [researcher] to produce a sociological account. But one that continues to privilege the voice of the subaltern.” (p. 126). Huber (2009b) builds on this understanding by suggesting that both the process and product of *testimonio* research is collaborative: “*testimonio* allows for participants to work in collaboration with the researcher, honoring their lived experiences and knowledge” (p. 650). Expanding on the collaborative nature of *testimonios*, Huber (2009b) provides support for her claim that testimonios help to dismantle the “apartheid of knowledge that guides traditional academic research” with her detailed description of the role of the researcher (p. 650). Huber (2009b) explains “My role is not to determine what is truth in the *testimonios* these women have shared with me, but to understand their realities within a larger context of structural and systematic inequality – within and beyond educational institutions” (p. 649). In following this logic, I also engage in a collaborative, dialogic process with the participants in this study in order to document their experiences and perspectives; however, in “privilege[ing] the voice of the subaltern,” I do not investigate the claims made in the *testimonios* but rather attempt to facilitate the understanding of these counternarratives (Huber, 2009b, p. 126).

The process for developing a counternarrative through *testimonio*, according to The Latina Feminist Group (2001), involves “the person bearing witness tell[ing] the story to someone else, who then transcribes, edits, translates, and publishes the text elsewhere” (p. 12-13). As Salvádar-Hull (2005) suggests in the title of her article “Mujeres Testimoniando: No Neutral Position,” the act of listening, transcribing, and presenting others’ stories is not a neutral act. She describes this position of non-neutrality in her discussion of Sandra Cisneros’ 1998 *LA Times* editorial on the murder of 46 women and children in Acteal, Chiapas (Mexico) on Christmas Eve in 1997 (Salvádar-Hull, 2005, p. 336). Salvádar-Hull (2005) writes:

Cisneros fully understands her position of power here. She asks, "What is my responsibility as a writer in light of these events? As a woman, as a mestiza? As a US citizen who lives on several borders? What do I do as the daughter of a Mexican man?" ("Nation" M2). Cisneros, as a public intellectual, knows that her responsibility entails providing the alternative discourse to the one the *LA Times* preferred. (p.337)

In reflecting on my role as a researcher, I recognize that my conversations with underrepresented minority and first-generation women graduate students in STEM disciplines provide an alternative discourse to the deficit-based literature on both women of color and first-generation college students in STEM fields. This alternative discourse counters the mainstream suggestion that STEM classrooms offer null environments with equal opportunities for all students. In light of this information, I, like Cisneros, question: what is my responsibility to share what I have learned? As a woman? As a graduate student? As an emerging feminist scholar of education cognizant of and interested in the intersection of critical race, socioeconomic, and gender issues? Similar to the way in which Cisneros “consciously interrupts ‘the mainstream national discourse’ of both the United States and Mexico,” I seek to interject alternative visions and versions of women’s

experiences in STEM disciplines that interrupt the deficit perspective with which women, and particularly women of color, are viewed and portrayed within academic literature (Salvídar-Hull, 2005, p.336).

The application of López and Davalos' (2009) reflection on the role of the researcher most similarly aligns with my own view of and intent to engage in this research. They describe the participatory nature of *testimonio* as a qualitative research method in noting that "researchers serve as engaged witnesses that recognize the contributions of their co-participants as critically important, which then powerfully reveals the very fact of their struggle. This recognition becomes a crucial moment of empowerment, one only revealed and affirmed by the testimonio process" (López & Davalos, 2009, p.19). Huber (2008) echoes this sentiment in noting that giving a *testimonio* is "a liberatory act" that provides a source of empowerment for individuals voicing their stories (p. 170). This study's use of *testimonio* facilitates the women participants' development of at least two of the four dimensions in Stromquist's (1995) conceptualization of empowerment; these four dimensions are cognitive, psychosocial, economic, and political. The two dimensions most relevant to this study are the cognitive and psychosocial. The cognitive dimension involves women's awareness and understanding of their oppression, and the psychosocial dimension results in women developing agentic perspectives and acting in ways that they believe will improve their own lives. López and Davalos (2009) and Huber (2008) reference both cognitive and psychosocial aspects of empowerment. Through their *testimonios*, the women participants create a collective counternarrative to the deficit literature on women, underrepresented minorities, first-generation college students in STEM, which, I contend, sets the foundation for political empowerment. In her model,

Rowlands (1997) describes political empowerment as “collective empowerment” and discusses the difference between “personal empowerment” and “collective empowerment.” According to Rowlands (1997), personal empowerment means “undoing the effects of internalised oppression” (similar to cognitive and psychological empowerment), and collective empowerment occurs when women “work together to achieve a more extensive impact than each could have had alone” (similar to political empowerment) (p. 15).

Necochea (2016) builds on this concept of collective empowerment in her own *testimonio*, which both conveys her experiences in and resulting emotions about American higher education institutions and, ultimately, provides evidence confirming that the United States is not a post-racial society. In discussing the role of academics, she describes an important distinction between solidarity in thought and solidarity in action when she writes:

Maybe to some academics it feels as if it is enough to speak of inequities in the class, to assign numerous critical readings, and to engage in group discussions. This might be a start, but this cannot be the end....it is not enough to enlighten minds with knowledge on how the world was racialized by the privileged if it is not accompanied by action. (p. 47)

In choosing to engage in social justice feminist research and write a dissertation using testimonials as a method, I want to do more than simply engage in discussion about inequities underrepresented minority women graduate students face in STEM disciplines; I intend to take action that contributes to collective empowerment by listening to the women participants’ voices and documenting both their obstacles and challenges as well as their strengths and assets, which serves as a counternarrative to existing literature and institutional rhetoric.

López and Davalos (2009) explain the way in which *testimonios* can be an example of action-oriented qualitative research. In their discussion, López and Davalos (2009) include a quotation from Castañeda's speech during the plenary session of the 2008 Mujeres Activas en Letras y Cambio Social (MALCS) Summer Institute, which powerfully sums up the role of the researcher who uses testimonials as a qualitative method: "Castañeda closed the plenary urging us to 'see your connections with all people who struggle—struggle with them, and fight like hell'" (Casteñada, 2008; López & Davalos, 2009, p. 19). In echoing the words of Huber (2010), I declare, as she wrote, "I want my dissertation to be a means of fighting against the injustice that they face. The dissertation is a form of resistance" (p. 845). By employing *testimonios* as the method of my research, I contend that these counternarratives not only matter as much as data collected from other methods but also are capable of providing a more authentic understanding of the experiences that underrepresented minority women graduate students in STEM disciplines have in American institutions of higher education.

In discussing how the process of collecting the data for *testimonios* should be carried out, Huber (2008) writes: "There is no single definition of *testimonio* or requirements for how this technique should be used in the research process, nor do I suggest there should be" (p. 169). The discussion above describes the various ways that scholars have engaged in research using *testimonios*. In developing the process for using *testimonios* as my data source, I built upon these successful examples and the results that emerged from my own research context.

Sample Population

I chose to focus on underrepresented minority women and first-generation women graduate students in STEM fields. The women who participated in this study are all graduate students in aerospace engineering, astronomy, computer science, environmental chemistry, and electrical engineering and self-identify either as an underrepresented minority student or a first-generation graduate student or both. I have chosen graduate students as the subject of this study because they have already demonstrated success by completing a bachelor's degree in their academic disciplines and have substantial experience in these fields of study upon which to reflect. My preference for first-generation graduate students is related to the primary research question of the proposed study, which is designed to investigate what assets or strengths that these women STEM students drew upon from their community cultural wealth (including funds of knowledge) in order to graduate from college. Although second-or third-generation graduate students have community cultural wealth, first generation graduate students are probably better able to recognize it in their own lives and are more likely to acknowledge its assets as support; their second or third generation counterparts may be more likely to refer to their additional cultural capital (parents'/family members' experiences in and guidance on attending college) as a primary support or asset to their success in their STEM programs.

My sample population was defined using stratified purposeful sample of female graduate students in STEM fields. In stratified purposeful sampling, the researcher creates stratified groups within the sample (Creswell & Poth, 2018; Weiss, 1994). Purposeful sampling, according to Patton (1990), helps the researcher to identify cases for in-depth study that will be rich in information. The sample population of this study includes

underrepresented minority and first-generation women graduate students in STEM disciplines and is then stratified by academic discipline (e.g., computer science, engineering, etc.).

Participants

I selected the participants in order to gather information about the reality of women's experiences in STEM disciplines and to understand what individual assets and/or institutional characteristics support women's acceptance into and persistence through graduate school. I chose graduate students as the participants because they have had substantial experience in STEM disciplines (at least four years while obtaining their undergraduate degree) and have demonstrated success in their field not only by completing their bachelor's degree but also by being accepted into a specialized advanced program of study.

To identify students with the above-described characteristics, I examined program and department websites at DMV University and contacted approximately 50 faculty members and/or administrative staff who were on campus during the summer session and were working with STEM graduate programs. I requested that they forward my invitation letter through their program/department/college's listserv to all the graduate students with whom they work. Because fewer faculty members and graduate students are on campus during the summer months (when the first invitation was distributed), the initial response rate from underrepresented minority women students was low: only two women who responded met the criteria for participation. In the fall semester, I followed the same procedure in contacting 120 faculty members and administrative staff to request their assistance in distributing the invitation letter at DMV University. Again, only three

students who responded to the invitation met the qualifications of the study. I also requested permission from the Institutional Review Board to expand the study to five universities in the Mid-Atlantic region of the United States. Upon receipt of approval, I contacted another 120 faculty members and staff from three other universities in the Mid-Atlantic region and again requested their assistance in distributing the invitation letter for my study to graduate students at their respective universities: not one of the students who responded met the qualifications for participants in my study. In total, over the course of five months, I sent approximately 300 emails requesting the email distribution of the invitation letter for my study to graduate students at four universities in the Mid-Atlantic region of the United States; however, the five women participants in this study are all graduate students at DMV University who responded either during the summer or fall mailing of the invitation letter. When students responded, I asked them to confirm that they (1) self-identified as an underrepresented minority woman and/or (2) a first-generation graduate student. I then had a second communication with the students who met these qualifications to explain the time requirements of this study, which I indicated would include two approximately one-hour long interview conversations and a focus group meeting.

The five women who participated in the study were: Alma, Bianca, Chelsea, Daniela, and Elizabeth. Alma is an Arab international doctoral candidate studying electrical engineering; however, most of her work is related to computer science. She is in the seventh year of her graduate program. Bianca is a second-year doctoral student in astronomy who identifies as half-white and half-Latina. Chelsea, a second-year master's student who identifies as African American and Greek, is studying computer science. Alma, Bianca, and Chelsea, all shared that they had significant others who have been sources of support

to them in their graduate programs. Daniela is a second-year doctoral student in environmental chemistry who is advised primarily by a faculty member in a related engineering field; she identifies (at different times) as Latina or Spanish, Native-American, and white of German ancestry. She is married. In addition, Daniela also shares that her low-income socioeconomic background has been an important part of her identity. Elizabeth is a doctoral candidate in aerospace engineering who identifies as white; however, her working class family's Russian orthodox Christian background has been an important part of her upbringing and a source of contention. She is also married.

All five of the student participants selected for this study attend one university: DMV University, a large, public research university near the nation's capital in the mid-Atlantic region of the United States. DMV prides itself on being dedicated to diversity and inclusion and gender equity, which suggests that it is favorably-suited to be the location for this study. As College Factual (n.d.) reports, the student body at DMV is more diverse in terms of ethnicity, gender, and geographic location than the national average for most universities in the United States. According to DMV's Office of Graduate Diversity and Inclusion (2018) approximately 48% of the university's more than 10,600 graduate students are women and 20% self-identify as minority students. For these reasons, DMV University presented itself a great place to examine the extent to which underrepresented minority and first-generation women graduate students' culture and the culture of the institution support their success in STEM fields.

Although the focus of the study is the women participants who self-identify as underrepresented minority and first-generation graduate students, I interviewed two STEM faculty members (male) with the intention of providing another perspective on the

institutional support available to women and minority graduate students in STEM fields. I endeavored to meet with two faculty who also held administrative positions in their STEM departments; however, after contacting eight professors, only two responded, and only one agreed to meet with me. Given such low response, I expanded the pool of potential interview candidates to any faculty member in a STEM field at DMV. The two participants from the professorate include one professor from DMV's electrical and computer engineering department and one associate professor from the computer science department. Although the ECE professor also holds an administrative role in his department, he admitted that he primarily works with undergraduate students in that capacity.

Data-Collection Methods

I conducted two semi-structured interviews with each of the five underrepresented minority and first-generation women graduate students. These interviews were designed to encourage students to reflect on their lived experiences and their trajectory in their various STEM fields: aerospace engineering, astronomy, computer science, environmental chemistry, and electrical engineering. The first interview consisted of seven open-ended questions about their experiences in STEM graduate programs and the extent of their familial/cultural support. On average each interview was approximately one hour. Although I used an interview guide, while reviewing the transcripts from the first conversation with the first three participants, I realized that the data that were emerging went beyond the straightforward interview responses. All of the women provided rich, detailed, and descriptive responses and readily shared stories about their experiences in undergraduate and graduate school. They also offered a comprehensive overview of their family support and their concepts of their individual backgrounds. Although both of our conversations were guided by interview questions, I let the women speak, and they spoke

at length during each meeting. For example, when I spoke with Bianca for the first time, we talked over a video conferencing platform for approximately two hours. During our conversation, my cell phone battery died despite that it had been charging during the entirety of our video conference call. In fact, we had to take a 20-minute break to allow our batteries to fully recharge; we then returned to the videoconference to finish the interview. The first meeting with Daniela, which lasted more than two hours, provides another example of the intense level of engagement of the conversations that I had with each of the women. When I met with Daniela for the first time, we both became so engrossed in the conversation that neither of us realized that our two-hour parking meters had run out of time.

The investment of time and energy during the second round of interviews was even greater than the first round of interviews: the average time for each second interview was approximately two and a half hours, and a few of the conversations lasted over three hours. During these conversations, the discussion revisited some of the challenges that the students had mentioned in the first interview and asked them to share the ways in which their family/cultural support and institutional support helped them to navigate these challenges. The questions also asked about their visions of success and their guidance for moving forward.

In following up to the second interviews, I contacted each of the women to ask a few clarification questions needed for the transcripts. The duration of these follow-up conversations was thirty minutes to one hour because the participants often shared additional related stories. In addition to these follow-up conversations, Alma, Daniela, and

Elizabeth initiated additional contact with me via email after our meetings to further discuss topics that they had shared with me during their interviews.

The next three chapters, which include the *testimonios* of the participants, show the ways in which their responses were characteristic of *testimonio*. My process of conducting and analyzing data collection was similar to the process that Barragan (2014) describes in her dissertation study on Chicana academics' experiences in completing doctoral degrees along the southwest border of the United States. Like Barragan (2014), I did not begin my study intending to collect *testimonios*. In applying the knowledge and techniques gained from other feminist scholars' presentation of *testimonio* (including Benmayor, 2002; Delgado Bernal et al., 2012; The Latina Feminist Group, 2001), Barragan (2014) explains, "I emphasize here that the researcher does not 'do' a *testimonio*. Instead, the researcher conducts an interview. Only after the interview was conducted did I determine whether the tenets of *testimonio* had been met" (pp. 66-67). Similar to Barragan (2014), I began my study by engaging in semi-structured interviews with participants, and only after conducting the interviews and transcribing the recorded conversations was I able to assess whether the participant had shared a *testimonio*. In her assessment, Barragan (2014) lists the following characteristics in classifying *testimonios*:

- "is told and reported in first person
- has a sense of political or social urgency
- is generalizable to others; we learn about the conditions of many from the story of one
- carries a desire for social movement and change, in contrast to oral history

- helps retrace, document, and organize our political, social, and cultural histories” (p. 67).

The first four components Barragan (2014) mentions are characteristics that I looked for in analyzing the interviews that I conducted; however, I replaced the fifth component with criteria more applicable to my study, which is *helps to re-conceptualize the understanding of what individual and institutional factors support students’ success in STEM disciplines*.

In addition to meeting the above-mentioned qualifications of *testimonio*, the data collection process adhered the best practices of qualitative research. Before each interview, as well as prior to the focus group session, I asked each student to review and sign an informed consent form, which described the purpose of the study, disclosed to respondents that the interviews would be recorded, and denoted the voluntary nature of their participation. To maintain confidentiality, I assigned student responses with pseudonyms. I was the only person with access to the recorded interviews, written transcripts and notes; I kept these materials locked in a secure location. In addition, I conducted member checks to establish accuracy and validity of the information collected. This process involved allowing respondents to review the information collected from them, refute any inaccuracies, and/or provide any additional information to or ask for clarification about the written transcripts (Mertens, 2015). To facilitate this review, I provided students with the written transcripts of conversations and/or their narratives for their review.

In addition to ensuring confidentiality and conducting member checks, I triangulated the data collected through semi-structured interviews, a focus group, and observations of students’ nonverbal communication during these conversations; the triangulation of data is another recommended practice of qualitative research. The focus

group reinforced the data collected during the interview conversations through the discussion of common themes that emerged from the individual interviews. Four of the five women participants attended the focus group: Bianca, Chelsea, and Daniela attended in-person, and Elizabeth participated via video conference. Reviewing the focus group transcript further solidified the characterization of the women participants' responses as *testimonios*, as described by Flores Carmona (2014). In articulating the ways in which the data that she collected for her study qualified as *testimonios*, she writes:

The testimonios I gathered are not only stories, but also reflections of the different oppressions these women faced in their daily lives, and they also have the potential to connect people from other subaltern or marginalized groups in society who share the same or similar oppressions in their daily lives. Testimonios make space for people to connect experiences, even when coming from different positionalities. (Flores Carmona, 2014, p. 118)

The connections that the women participants in my study made among one another during the two-hour focus group were visible and authentic: they shared their delight at having found other women with whom they could relate and even exchanged contact information at the end of the focus group session.

In addition to conducting a focus group with student participants, I interviewed two faculty members who work in administrative capacities. These interviews provided insight into the institutional/departmental perspective of the institutional support available to underrepresented minority and first-generation women graduate students in STEM disciplines. The appendices to this study include the invitation to the study, the two student interview guides, the focus group interview guide, the program director invitation to the study, the program director interview guide.

Limitations of the Study

Although the five women participants' testimonios provide rich, detailed descriptions about their experiences as underrepresented minority and first-generation women graduate students in STEM fields, these exact findings may not be directly transferable to all underrepresented minority and first-generation women graduate students at DMV University or any other universities. However, in recognizing the differentiation in each of the women participant's background and experiences, this study shows that while the particular assets and strengths of each woman's individual culture are unique, the support that they provide are the same. Yin (2003) uses the term analytic generalizability to explain how findings from qualitative research are generalizable to theory. This term is applicable to this study, which shows that the assets of students' community cultural wealth are distinct but equally valuable to their success in gaining access to and navigating challenges in graduate school. In addition, while the specific challenges that the women face in their institutional context may be different, the fact that they all report having experienced challenges due to a lack of institutional support suggests that this qualitative research provides, what Charmaz (2006) describes as, a descriptive account of a social phenomenon. Because participation in the study was voluntary and students self-selected to participate, issues with credibility could exist. In recognizing this possibility, the study design included triangulation of data through interviews, a focus group, and observations of nonverbal communication during those conversations. In addition, interviews with faculty members in STEM fields provide another perspective on institutional support.

Data Analysis

I designed the interview questions with the intention of collecting data for each of my three major research questions:

1. What assets or strengths did underrepresented minority and first-generation women graduate students draw upon from their community cultural wealth (including funds of knowledge) in order to in order to access and navigate through graduate degree programs in STEM fields?
2. What institutional factors do underrepresented minority and first-generation women graduate students identify as having contributed to their gaining access to and navigating through their graduate degree programs in STEM?
3. What similarities and differences do women students experience in navigating their higher education institutions?

However, because I let the women speak and because they spoke at length when sharing their background and experiences, their responses did not always map directly from each interview question to the related research question. The benefit was that the data that emerged from the interviews provided descriptive, personal, and reflective answers to the study's research questions. In presenting the findings, I share these women's stories and experiences through their own voices to the greatest extent possible; however, as Huber and Cueva (2012) contend, the purpose of *testimonio* goes beyond conveying an individual's experience to providing insight into a collective social phenomenon. *Testimonio*, according to Huber and Cueva (2012), enables women to develop "a broader understanding of their educational journeys as connected to a collective struggle" and

“create a collective counternarrative of themselves and each other where their academic and cultural strengths [can be] reinforced and celebrated” (p. 404).

For that reason, I did not just copy and paste the women’s narratives, but rather, I reviewed the interview transcripts multiple times based both on a priori and emergent themes within the data and shared the most pertinent narratives that offered responses to the study’s research questions as my findings. I present the findings in three chapters, which correspond to each major research question of the study: an analysis of individual factors that support underrepresented minority and first-generation women graduate students’ success in STEM fields, an analysis institutional factors and the extent to which they support the women participants’ success in their STEM fields, and an analysis of women’s insights into their graduate educational experiences.

The women’s narratives, which came from the student interviews were the primary source of data for each of my three research questions. *Testimonios* have rich, descriptive, and in-depth information about a subject’s lived experiences, and although specific details may not be directly transferable beyond the subject herself, the women’s multiple voices provide unique accounts of their collective experience as women who are first-generation graduate students from marginalized backgrounds in STEM graduate programs. To complement the information provided by the women in their *testimonios*, a secondary data source (e.g., a student focus group, interviews with faculty chairs) supported information related to each research question, as shown in Table 2 below.

Table 2: Research Questions and Corresponding Sources of Data Analysis

Research question	Data source(s)
What assets or strengths did underrepresented minority and first-generation women graduate students draw upon from their community cultural wealth (including funds of knowledge) in order to access and navigate through graduate degree programs in STEM fields?	Primary: Student interviews Secondary: Student focus group
What institutional factors do underrepresented minority and first-generation women graduate students identify as having contributed to their gaining access to and navigating through their graduate degree programs in STEM?	Primary: Student interviews Secondary: Student focus group; faculty interviews
What similarities and differences do women students experience in navigating their higher education institutions?	Primary: Student interviews Secondary: Focus group and observations during interviews and focus group session

In presenting the narratives related to the first research question (individual factors that support underrepresented minority and first-generation women graduate students' success in their STEM fields), I analyzed the transcripts using Yosso's (2005) community cultural wealth conceptual framework, which includes aspirational capital, linguistic capital, familial capital, social capital, navigational capital, and resistant capital.

The findings presented in the subsequent chapters unpack the various forms of community cultural wealth and describe how they apply to this study while highlighting the connections among them. *Familial capital* includes family and cultural knowledge and skills and overlaps with funds of knowledge but also includes familial/community knowledge, values, and history in addition to skills. The women participants in this study share how their familial capital instilled in them not only their love of education but also

their interest in their specific STEM fields despite their families not having a formal educational background in these fields of study. *Aspirational capital*, according to Yosso (2005), includes students' and their families' "hopes and dreams for the future" (p. 77). Although the women participants' families did not know the process for or requirements of applying to graduate school, they all held high aspirations for their daughters' futures and supported them in multiple ways.

Linguistic capital is best described as students' abilities to understand the world and express themselves in more than one language. These complex communication skills are a benefit to students: in addition to knowing how to present and discuss their research in more than one language, one participant described the ways in which her language skills have also provided her with an advantage in learning specific science languages. This linguistic capital is part of her funds of knowledge, which, as Moll et al. (1992) explain, includes cultural and familial knowledge and skills that are "essential for household or individual functioning and well-being" (p. 133). Bianca's language skills and her money management skills, which were passed down to her through her family, are part of her funds of knowledge. *Resistant capital*, according to Yosso (2005), is the "knowledges and skills fostered through oppositional behavior that challenges inequality" (80). Alma's linguistic capital is also a form of resistant capital: her Arabic and French language skills were an asset that she capitalized on to when trying to acquire funding to remain in her doctoral program.

Social capital involves students accessing both the formal and informal social networks that they acquired during their undergraduate or graduate degree programs. These networks include university established student organizations and connections through and

among students' peer groups. *Navigational capital*, according to Yosso (2005), is students' ability to navigate educational spaces that are not defined by or reflective of communities of color. The participants in this study are women of these demographic backgrounds who have used their familial capital to create perspectives with which they have navigated their paths through higher education.

In sharing the findings for the other two research questions related to institutional factors that support underrepresented minority and first-generation women graduate students' success and their experiences in their STEM programs, I present the women participants' narratives thematically, based on the common issues and topics that emerged from the data. The following chapters provide an overview of the findings from the data collection methods mentioned above.

CHAPTER FOUR: ASSETS AND STRENGTHS OF COMMUNITY CULTURAL WEALTH

Introduction

I intended to look at the extent to which women who self-identify as underrepresented minority and first-generation college students drew upon their community cultural wealth (including funds of knowledge) to graduate college. However, the women who responded to the study announcement self-identified as first-generation graduate students rather than first-generation college students. As first-generation graduate students, Alma, Bianca, Chelsea, Daniela, and Elizabeth all indicated that at least one of their parents had a college degree but neither parent had a graduate degree. Consequently, they had expectations that their daughters would get a bachelor's degree, as Bianca shared: "I think my parents assumed I would go to undergrad. That was never really a question."

Although they had aspirations for their daughters, the extent to which they could offer concrete advice about the application process and college experience varied. For example, Chelsea and Elizabeth said that their parents took them to visit multiple universities when they were applying to their undergraduate degree programs, which Chelsea recounted as "really awesome." However, Chelsea also indicated that her college application process and experience were different than that of her parents who went to college at a local university while working. So, Chelsea and her parents were learning about the application process together. Chelsea explained: "For undergrad, my parents had a different experience with college. [While attending college, they also worked.] They didn't apply to eight schools; they were figuring it out with me."

In our conversations, the women reported that at least one of their parents was able to offer limited experiential knowledge and guidance about college; however, they all

indicated that their parents were unable to provide concrete advice about the graduate school application process or the graduate school experience. Despite the lack of guidance, the women all shared detailed accounts about the multiple ways that their families offered important support. For example, as Bianca indicates, although her parents were not familiar with the graduate school process, they always encouraged her to go further in her academic and professional endeavors. In discussing her parents' role in her application process to graduate school, Bianca said:

They didn't really push me, but they kind of knew I had to do more. They wanted me to get out and do more. But, they weren't able to help me apply to grad schools; they weren't able to tell me what it would be like. They had no idea that I could get paid to go to grad school. They told me they would help me with undergrad, but then I ended up getting a free ride for undergrad. But, they told me that they probably wouldn't be able to help me to pay for grad school. They didn't know.

In her narrative, Bianca explains how her parents assisted her financially during her undergraduate degree and were supportive of her going to graduate school but had neither the information to help her through the application process nor the resources to contribute financially. Elizabeth also expressed that her parents' encouragement was supportive to her although they were unfamiliar with what graduate school would be like and therefore unable to offer specific guidance. In describing the support that she received from her parents, Elizabeth said: "My parents not doubting that I would be able to succeed even though they don't know exactly what the path looks like has been helpful."

Chelsea, like Elizabeth, noted the support from her parents, especially her mom, was an important factor in her applying to graduate school. Chelsea credits her mother's support as the motivating factor for her completing her graduate school applications. Despite the fact that she was unfamiliar with the graduate school application process,

Chelsea's mother read her personal statement and worked with her to brainstorm potential people to write her required letters of recommendation. In describing the support that she received from her mother when she was applying to graduate school, Chelsea shared:

Her [mother's] support and her believing in me really got me, I think, through that time and motivated me to actually apply to graduate school. She helped as far as you have to write a personal statement; she helped me revise mine and things like that. I definitely talked to her about every step of what I was doing because I talk to her so often. So, there's not too much hand holding she could do through that process, but she helped me think of people to write recommendations. She was there for me as much as she could be.

The pieces of the women's narratives presented above provide a glimpse into the discussion contained in this chapter, which highlights the important sources of familial and cultural support that the women reported as influential to their academic trajectories and examines them through the lens of Yosso's (2005) community cultural wealth. The framework of community cultural wealth includes familial capital, aspirational capital, social capital, navigational capital, linguistic capital, and resistant capital. The women's narratives suggest that each asset has served as a source of support and that their community cultural wealth has been important to their success at multiple instances during their academic trajectories.

Familial Capital: Support for STEM Education

The deficit literature on first-generation college students suggests students do not have access to the cultural or social capital (Martin, Simmons & Yu, 2013; Ohland et al., 2011) needed to access STEM fields and that they can achieve academic success only *despite* their family backgrounds (Orthner, Jones-Sanpei, & Williamson, 2004). However, Daniela and Elizabeth described the ways in which their familial capital played a part in developing what Yosso (2005) refers to as "educational consciousness," which instilled in

them a love of education (p. 79). For Daniela and Elizabeth, their familial capital went even further than encouraging an abstract appreciation for education; it fostered their specific interests in their chosen STEM fields, and for Elizabeth, contributed to her success within her STEM field of study.

In her *testimonio*, Daniela expresses how her love of and interest in environmental science came from her happiest childhood memories when she was camping with her family. Daniela also discusses her parents' value of Catholicism. Although she does not have the same connection with the religion that her parents have, she compares the connection she has with nature to that with her parents' connection to religiosity. In addition, she discusses the value that her mother placed on education, and despite the challenges that she encountered in her childhood, she explains that higher education "was always something that I knew I would eventually do." In sharing how she became interested in her STEM field, Daniela said:

In short, I grew up camping in the redwoods, and both my parents are hippies. And at an early age, a love of nature kind of just developed. And as I got older, I started becoming more aware of environmental problems. And nature in general has always been kind of my escape. I was outside a lot as a kid. I still love being outside; I'm from California, but I don't really go outside as much as I used to, which makes me sad. So, I started out as biology, but then I realized that I loved chemistry, and then, I learned more about chemical pollution and how widespread it is. And then, I learned about [specific field of interest] and fell in love with that specifically. I'm not religious, but I think my relationship with nature is like almost at that level. It's really important to me. I think what's important to me is preserving nature and the connection with it – not just natural resources, but how it can be feeling almost. And then, I also just like chemistry and am super nerdy about it, and I like science. But as far as specifically, why I just chose that – that's why. So, camping I think was one of the few good memories I had as a kid. My childhood in general wasn't great, especially my early childhood, I don't really have a lot of good memories. My parents were just fighting a lot in general, and then they divorced when I was 10. But before they divorced, and it got really bad, we were camping a lot. So, I think I just early like associated being happy with being outdoors, and that seemed to be the time when they didn't fight a lot. So, yeah. I think in general I found that my happiest memories were outside and not in the

house where like there was fighting and drug use and things like that. So, yeah. And then also, my parents are both very Catholic, and it just didn't make sense to me, I guess that connection with the divine that I think people cherish in their faith. I didn't get from Catholicism, and I never got from church or anything. But the closest I ever felt with divinity or religion was being in a storm, or being at a beach, or when I scuba dive. So, for me, protecting nature is like a protecting a religion, and protecting what's sacred to you. And then there's also just the fact that like I really like chemistry, and I find it really interesting. And I've always been really nerdy and read a lot of books, so it also just fit my personality to continue with my studies. So, it's something I've always been really good at it. So, I was lucky because I was also good at math. I actually dropped out of high school half way through. I went into independent studies, which is a load of crap. I would stay up all Thursday night and finish my homework and did nothing. I purposely I held myself back when I started community college actually for that reason because I didn't feel like I didn't learn anything. There was a lot of stuff going on at home. My parents were divorced. My dad was absent; we had no money. My mom's schizophrenia had really developed, and she was in and out of the hospital a lot my freshman year. And like a lot of stuff was going on, and school was like not on my priority list. I couldn't pay attention. I didn't care. I knew about community college. My mom has a bachelor's degree, and she taught for many years, so the value of education was instilled in me early on, even though, unfortunately, later like in high school she wasn't really cognizant, I guess. But yeah, school was important. She always valued good grades. And even though my dad kind of became absent, he was the one to organize the camping trips, and I remember reading national geographic magazines that he left around. So, even though I kind of abandoned school in high school, it was always something that I knew I would eventually do.

The values of respect for and conservation of nature, spirituality, and education that Daniela's parents instilled in her are the assets she received as part of her familial capital. Yosso's (2005) model of community cultural wealth defines familial capital as the "cultural knowledges" that "inform our emotional, moral, educational and occupational consciousness" (p. 79). This "cultural knowledge" includes the values and perspectives that Daniela's family passed onto her, which served as a guiding framework for her academic pursuits in her graduate STEM field.

Elizabeth's account also highlights the way in which familial capital is an important asset in developing students' academic interests and supporting their educational pursuits.

Similar to Daniela, Elizabeth describes how her familial capital provided her with sophisticated knowledge that encouraged her specific academic interest in aerospace engineering. In explaining how she became interested in aeronautical engineering, Elizabeth reflected:

I think it was subconscious. I didn't realize it at the time. My parents both worked at NASA Godard Space Flight Center at different times in their careers. They were both technicians, so they were blue collar jobs at NASA. They had both worked in the auto industry, and the same things that you have to do for cars, you have to do for space crafts. So, my mom worked there before I was born, and then for summers when we were young. My dad worked there off and on for like maybe 20 years or so. So, that's the reason that I was exposed to aerospace, and I like space. Honestly, I didn't go that often [to Godard], but it might have been on take your child to work day or for some other reasons. I only remember going a few times at most. I remember playing in my dad's workshop because he was a tech, a technician, so they had a workshop. And it had all these cool space tapes that we were like really shiny tapes that were probably pretty expensive. He let me play with them. So, I remember that was cool. I remember going to the visitor's center and getting a book on the planets. And just that book I remember being like, wow Jupiter is really cool, and all the planets are really cool. And then the other thing that we did besides go to Godard was we went to two launches of rockets from Florida. So, we went down to Canaveral, and we watched the rocket launches, which was really cool. So, I think having that experience and having gone to Godard before is what exposed me to space and got me excited about it. They [my parents] were supportive of me doing graduate school, but they would have never told me to do graduate school. In fact, something that I always tell undergrads now that I didn't know is that usually in engineering, your graduate school should be paid for; you should get a stipend and tuition remission.¹ But I didn't know that. So, I remember my parents being like we're going to pay for undergrad, but then you have to figure out graduate school on your own. But, they didn't know that graduate school is paid for or should be. They supported me in going but didn't push me to go. They always supported me and took me to look at schools with aerospace programs and all of that.

Elizabeth recounts with detail how her visits to Goddard Space Center and Cape Canaveral are what sparked her interest in space and later aerospace engineering. In

¹ Elizabeth explained that it is common for graduate students in engineering fields to either have assistantships on campus, which pay a salary and cover the cost of tuition, or to have financial support from industry jobs that offer tuition reimbursement benefits. She shared that her professor told her that she should receive a stipend as a graduate student, which would increase incrementally with the number of years that she is a graduate student.

addition, she notes that although her parents were unable to offer knowledge about or financing for graduate school, they provided instrumental support in taking her to visit universities with aerospace engineering programs.

The narratives of this section show how underrepresented minority and first-generation women graduate students' familial capital not only fostered their love of and appreciation for education but also has helped to cultivate their interest in their chosen STEM fields. These narratives are contrary to the findings from the literature that examine first-generation college and underrepresented minority students from a deficit lens and instead show that these women have had access to concrete forms of cultural capital: the women describe how their familial capital instilled in them the value of education and supported their interest in STEM, and social capital provided them with access to social networks that have supported their professional development in STEM. The women's *testimonios* show that their familial capital taught them about the value of education and contributed to their decisions to specialize in their chosen STEM fields.

Aspirational Capital: Support for Graduate School

Bianca, like Elizabeth and Daniela, highlights how her familial capital includes a love of knowledge and respect for and dedication to lifelong learning, which encouraged her to pursue a doctorate degree; however, like Elizabeth, she also describes how the value of knowledge did not directly translate to an understanding of the prerequisites for or the process of graduate school. Instead, her family offered her aspirational capital, or hope for her future. In describing how her grandfather's own pursuit of knowledge played a role in her decision to go to graduate school, Bianca said:

On my mom's side, there are some uncles that have master's, and I had an aunt who worked at a university; and I really looked up to her. She worked at the only

university in her region in Latin America. Both of my grandfathers were very much dedicated people. One of them was sort of a lifelong learner, even though he didn't really have any sort of formal academic education, but he taught himself four languages. He was really interested in Mayan culture, and he would just sit me down and try to teach me some of these ancient languages that he wasn't getting from research papers or something, but he was just reading a lot of text, and just trying to piece things together himself. I think I was inspired a lot by his curiosity and the fact that he was in his 90s, and he was still trying to pick up things and still trying to teach himself things. He was really excited about collecting historic artifacts, and he had a lot of interest in plants and languages and cultures, and just everything about his country he was in love with. He was always trying to learn more, and I think he encouraged all of his grandchildren to come sit on his knee and learn about whatever he was studying at the time. He didn't really say it out right, but I think he really was an advocate for life learning, which I still think about it to this day like how I would want to make him proud by doing a PhD. I don't know. I think my parents assumed I would go to undergrad; that was never really a question. They didn't really push me, but they kind of knew I had to do more. They wanted me to get out and do more. But, they weren't able to help me apply to grad schools; they weren't able to tell me what it would be like. They had no idea that I could get paid to go to grad school. They told me they would help me with undergrad, but then I ended up getting a free ride for undergrad. But, they told me that they probably wouldn't be able to help me to pay for grad school. They didn't know. They had no idea how expensive it would be or that I had to start preparing for this test [GREs] early on, but I think they always encouraged me go further, to do more, and reach farther, but they weren't sure what that would look like.

Although Bianca's parents were not familiar with the logistics of or requirements for applying to graduate school, they always wanted more for her than what they had for themselves. While Bianca suggests that the encouragement that she received from her parents was supportive, she explains that the motivation to pursue graduate school that she received from her family went beyond her parents' wishes and hopes for her: Bianca describes how her grandfather both valued and engaged in lifelong learning himself and invited her to share in his self-directed educational pursuits since she was a child. She details how her grandfather modeled the importance of continuing education and shared both this value and his interest in learning with her, an experience she indicates was a motivating factor for her pursuing a doctoral degree. Although her family was unable to

provide her with concrete advice on how to access graduate school, her grandfather modeled dedication to and involvement in lifelong and self-sustained learning, which is guidance that goes further than the moral encouragement or support that most underrepresented minority or first-generation college students receive: instead Bianca's grandfather not only told her that he wanted her to do well in her educational pursuits but also showed her how to succeed as a student.

Chelsea, like Bianca, is motivated by her parents' aspirations for her. In addition to their hopes for her, they share knowledge with her from their own experiences. In her narrative below, Chelsea describes how their wishes for her, wisdom to her, and belief in her motivated her to pursue her degree and encouraged her to persevere through and complete it before starting a family. In discussing the role her family played in the decisions she has made in her academic life, Chelsea shared:

My dad was one of 10, grew up in a poor neighborhood of New York, and had nothing. His mom had no money and was a single mom. He started working when he was eight as a paper boy and had to work himself up in the paper company. He had to forge documents, so he could get his driver's license early to make more money. He's been working at the same company since he was 19, and he's going to be 60 this year. He's now a vice president in this company. He worked himself up from nothing. He's very humble about it. He's never even told me this; I had to get the story as I grew up. And my parents have always tried to give their kids the best. I mentioned briefly that I went to a private school for high school that was like this fancy college prep school, not in my neighborhood. I guess they just expected me to go to college and be successful even though they didn't really have examples of that. They didn't really have examples of the life that I was living because of them since they went at it a different way: they had to work themselves up by themselves. For undergrad, my parents had a different experience with college. [While attending college, they also worked.] I have been trying to not do that. My mom talks about how hard it was and how crazy it was. She was working, going to school [college], and had kids. So, I've been trying to get this done earlier in my life before I start a family just so it's easier for me. Yeah. That's been her advice, "Get this done now. And then you'll be set." So, I have four siblings, and I'm the only one to graduate from college so far. My mom and I talked about this like how much of this is in me and how much is them? But, every kid is different. But these are the things I know that I have seen from my parents. They didn't apply to eight

schools; they were figuring it out with me. But, they took me to visit all the schools. We visited [various schools in northeast] and all these schools on the east coast. So, they took me to do that, which was really awesome and a bunch of schools in the Midwest. They've supported me financially when I've needed it through undergrad and grad school since my stipend is so low. I have needed their help. So, they've supported me, and my mom and my dad really want me to just get through it. They have faith in me that I will be able to be independent once I graduate. So, that's been really nice to just have my family believe in me and trust that I will achieve my goals once I finish this. So, that's helped a lot even when I really haven't believed in myself. For example, there was a time period when I wasn't sure if I was going to go to grad school while I was working in a lab in Michigan. It was kind of a lonely time in my life. I moved out there all by myself not sure what I wanted to do for my career or how long I would be there. I was having some issues with depression, and it was kind of hard to pick myself back up and believe in myself enough to apply to graduate school. And I don't think I would have been able to do it without my mom believing in me and just having no doubt that I would get into grad school and that I would be able to get into a program that I liked and that I would be able to do whatever I wanted in my career. So, just having her support and having her to talk to on the phone. It was a busy time because at one point, I was working full time, taking a class, and applying to grad school. I had to take GRE and all that stuff, and I was all by myself in Michigan. So, yeah. just having her support and my family. She's just the one I talk to the most. Her support and her believing in me really got me, I think, through that time and motivated me to actually apply to graduate school.

The stories about her father's success and her mother's perseverance offer a narrative of hope and possibility for Chelsea: her parents, despite experiencing challenges, have "worked themselves up themselves." In addition to this legacy of hard work, they provided Chelsea with aspirational capital for her future: they offered her guidance from their own experiences, hope that her academic and professional trajectories would be easier, and belief in her ability to achieve her educational and professional goals. Chelsea also explains how her parents provided her with tangible support for these aspirations: they sent her to a private college preparatory high school outside of her neighborhood; they took her to visit universities throughout multiple regions of the United States; and they provided her with financial support during her undergraduate and graduate education.

Chelsea attributes some of her success to her parents when she refers to her experiences as “the life that she was living because of them.” When discussing how she is the only one of her siblings to complete college and attend to graduate school, she shares that her parents’ experiential knowledge has been influential to the choices that she has made and the actions that she has taken. She says, “These are things that I know that I’ve seen from my parents.” She also indicated that her mother’s words of encouragement and belief in her was what actually motivated her to apply to graduate school.

Alma also discusses the importance of her family’s support for her. In addition to providing material support through money, housing, and food during her undergraduate program, her parents were also willing to go into debt from taking out a loan to support her in attending her dream graduate school, despite it costing substantially more than they could afford. Although Alma ultimately chose to attend another graduate school where she was offered a funding package because she was not comfortable having her parents take out a loan that could put them in a precarious financial situation, her narrative shows her family’s aspirations for her and the extent to which they would have gone to support her in achieving them. In explaining the support that she received from her parents, Alma said:

Financially, they paid for my undergrad degree, which was expensive for Middle Eastern standards. I lived with them through college. When I pulled all-nighters, my dad would drive me to school. Little things like that. There was also comfort in coming home, and there is food ready. That’s for my undergrad degree. In applying to grad school? Of course, they don’t know, my parents, at least, because they don’t speak the language, and most importantly, they didn’t go to grad school. But, they were very supportive in the application process when I was hearing back. I actually got in at Prestigious University, which was my dream place for graduate school, but I didn’t get an assistantship. That was a tough decision to make. I sat with my parents, and we went over how much it would cost to go to Prestigious University. And back then I didn’t really understand at what point I would be guaranteed funding because a PhD program is a long time. So, it was a very scary thing to say it’s going to cost \$100,000 a year, and it might be five years. My parents said, “If

that's what you want, do it; we'll find a way." Of course, it was beyond what they could afford. But, they were willing to go in debt to send me to my dream school. I wasn't willing to put them through it [so, they did not take out the loan]. They just bought a house. So, they had a mortgage. Not that I would have done it if they didn't buy the house. But I was thinking they had just put themselves through a loan already. So, yeah, they were very supportive.

The narratives in this section illustrate the ways in which familial and aspirational capital have served as a system of support during the women's college experiences and application process to graduate school. Being first-generation graduate students, these women's families did not know the process for or requirements of applying to graduate school; however, the women explain how their families held high aspirations for their daughters' future educational achievements and supported them greatly by offering words of encouragement and concrete actions, even when that support could have been to their own detriment, as Alma's narrative shows.

Social Capital: Support for Graduate School

Elizabeth's experiences highlight the importance of social capital or social connections in gaining access to information about and resources for graduate school. It was through social capital that Elizabeth was able to access opportunities for experiential education in her STEM field during graduate school. In her narrative below, Elizabeth explains how her parents' social capital was a resource that she used for her professional development when attaining an internship or co-op in her father's working group. Elizabeth said:

One of the first internships or a co-op [cooperative education internship] I got was in my dad's group so that definitely helped me. Although I actually would have gotten a co-op in a different group totally separate from my parents, so I feel like I still could have made it without them, but that tangibly affected me.

Although Elizabeth downplays the importance of her father's connections in being selected for an internship, she admits that she was "tangibly affected" from the

ways in she was able to employ the strategic resources of her father's social capital in gaining related professional experience.

Bianca provides another example of support that she received through social capital. Bianca's social capital comes from the extended social networks of her father's rural town community; however, the support that Bianca received was indirect as compared to the direct support that Elizabeth received. Bianca describes how people from her small rural hometown in middle America directly contacted her or put her in contact with others from the same city when she moved across the country to attend her undergraduate university. Although she was not personally acquainted with these people, they were eager to provide social support to her both by welcoming her to a new city and by celebrating her accomplishments. In sharing the multiple ways in which this social network supported her, Bianca said:

There was a person living in the town where I went to undergrad who grew up in the twin city associated with my hometown. She still reads the hometown paper online and read that I was on the dean's list and saw that I was going to this university. So, she found me online and asked to take me out to dinner. A complete stranger who said, "Oh, my son wants to go to this school, and he wants to study your major. You have a lot in common. We'd love to take you out to dinner and get to know you." Then, I was working after my senior year [of high school] in the local k-mart, and strangers would ask, where are you going to school? And there was a guy one time who asked, where are you going to school? And I told him, and he said, "Oh my daughter is going to a university in the same city. Maybe I can put you in contact with her." I recognized the last name, but I didn't know that family at all. And he put me in touch with his daughter, and she ended up taking me apple picking at an orchard near where we were going to school my first week there. So, this network of strangers is very supportive and friendly. There's a lot of bad traits, especially now, associated with fly over America. There was a lot of racism, but people are still friendly, and when they see you as one of own; they were very proud and friendly. So, maybe their politics inclination speaks one way but, the way they treat you person to person is nice. Maybe a lot of people didn't have a lot of progressive ideas, but if they knew [of] you, they were loyal to you even if they didn't know you.

Both Elizabeth and Bianca's experiences show how the extended social networks that they had through their families and communities served as important sources of support for them during their higher education. Through the direct support that Elizabeth received from her father's social network, Elizabeth was able to access professional development opportunities in her field. Although the resources that Bianca received through her community social networks were more indirect than those that Elizabeth received, she did receive moral and social support from people from her hometown when she moved across the country to attend her undergraduate university.

Familial Capital: Support in Graduate School

The next section shows how the cultural strengths and assets that the women have brought with them have helped them to successfully navigate the challenges that they experienced during their graduate programs. The narratives below highlight the roles that familial capital has played in helping students to succeed in their STEM programs.

For Alma, her strong connections to her family have been an important support throughout her graduate school experience. Whenever she was having a difficult time, she would either call or visit a family member who would remind her of her accomplishments and offer her words of encouragement. She also describes how she found both support and comfort in her mom preparing food for her: the food provided sustenance when she was busy and a reminder of home when she was sad or nostalgic. Alma describes her family support in her narrative below:

I could go spend the weekend with my sister if I wasn't feeling good, or she would come down from New York. I have 20 cousins on my mom's side, so I could just call one of them. I talk to my mom every single day for over an hour. So, all these things were a support system to me. I think that families don't work like this in the U.S. or most of them don't as least. There isn't as much contact. When I tell people that I talk to my mom for one hour every day, people are like, "*What* do you have

to tell her? Sometimes, we don't talk about anything important but just knowing that she is aware of my everyday life, and that's what she wants. She asks, "What did you eat today?" That kind of stuff. And I think that helped me a lot, and whenever I was going through a hard time. Even yesterday, I'm preparing my dissertation right now, and my advisor has told me multiple times, "Stop worrying about this; you're going to a job. Just write this thing and come give us your presentation." And to this day, I question myself: I'm like, "do I really deserve this? Have I done enough?" I would always talk to my mom about it or my dad. And they just talk me out of this reasoning or imposter syndrome. So, I think they were really my support system through a lot of things I went through. Having that and just being able to go to New York or go to my cousin. I have a few cousins in Boston, and I went to visit them multiple times. I was lucky that I have family here, and my parents are available to talk to me. They would remind me of my accomplishments. They said you said, "Your paper got accepted, and their acceptance rate is 15 percent, so logically that means you did a good job. You just got an internship and a return offer." Rational things. Sometimes they would just help me to get my mind off of things. My mom bought a plane ticket and just flew here one time when I wasn't doing well. I was going through a rough time: it was around the time I was changing advisors, and I wasn't finding another advisor. I was almost out of the program because I ran out of funding. And my mom said, "Come pick me up from the airport the day after tomorrow. I booked my ticket." I was lucky that I had a supportive family and that I'm able to count on them. Maybe sometimes just having my mom's frozen food in my freezer when you don't have time to cook; and you're homesick, and you miss your mom's cooking. You just thaw it and eat it. For us, that's almost more of a tradition; we're very food oriented. A lot of love is shown through food. "Oh, you're not feeling well? Let me cook your favorite meal. You just graduated? Let me cook this feast for you." This is how we show love. We cook meals for each other. That's why it's so important to me that I have my mom's food in my freezer, and every time she comes she brings goodies, supplies: zaatar, tahini, and different things. So, yeah, just having that: it's a part of home that's here. It helps.

Alma also shared some cultural sayings that reflect the support of her of family that she describes above. Alma shared:

Actually, there is a saying. I don't know how to translate it. I'll do a word by word translation, and then I'll explain it:

أنا وأخي ع ابن عمي وأنا وابن عمي ع الغريب

"My brother and I against my cousin; and my cousin and I against a stranger."

Basically, this is the order in which you prioritize people. If you your brother was fighting with your cousin, you side with your brother. If your cousin is fighting

with a stranger, you side with your cousin. So, yeah. When it's family, my uncle, he's going to support me. My mom, she's going to support me, and I take that for granted. Just the fact that I take that for granted, I don't even have to think, "Are they going to accept to do this?" I just know.

In our conversation, Alma provided a specific example of how this saying and the support it embodies are applied in actual circumstances. When she first came to DMV University, she was unable to get an apartment on her own because, as an international student, she did not have a credit history or a social security number. When her uncle, who lived nearby, heard about her difficulties, he did not hesitate to help her, as Alma recounts below. Alma said:

My uncle signed up with me as my guarantor [in order to rent an apartment] because I didn't have a social security number; I had no credit history or anything [on account of being an international student]. He co-signed the lease with me. So, things like this were also a lot of help that I know a lot of other grad students had a tough time because they didn't have family. Just cosigning a lease with me, for example, was a huge deal that my uncle did for me and is also a sign of trust. He was responsible if I wasn't going to pay. But, this is how my culture is. Family comes first.

The saying that Alma shared highlights the values inherent in her family capital: "family comes first" and exemplifies how this value was both an important source of emotional and material support to her during her experience in graduate school.

Alma indicated that although her family uses inspirational sayings, such as the one below, for her, it's not the sayings that are important but rather the values they reflect. However, in the narrative below, Alma describes how the sayings reaffirm her family's love and support for her, which has been an important source of moral encouragement to her. Alma stated:

من طلب العلا سهر الليالي

"he who asks for glory, stays up all night"

It's like if you're aiming for something so high, you have to work hard for it; it's not going to be easy. For my family, that I'm getting a PhD is a huge accomplishment and yeah, they started calling me Doctor. They've changed my name to Dr. Alma on the phone. Yeah. Things like this. But, I don't know if it's the quote itself [that's important]. It's what they reflect that helps me; it's not the quotes themselves. Our values and our traditions are very family oriented. That's what really helps me. I'm not a big inspirational quote person, but I do have a picture of my parents hanging next to my computer monitor at work, and I have pictures at home. I'm reminded that these people are here for me no matter what. Even if I am a failure, they will be here for me. So, yeah.

Although Alma suggests the sayings themselves are inconsequential, they are one way that her family reaffirms their support for her, and this support is an essential contributing factor to her success, which Alma not only directly stated but also conveyed through multiple examples. These sayings reify and reflect the actions that her family is willing to take to both support and validate her success.

Similar to Alma, Elizabeth discusses the material and emotional support she has received from her family, which helped her both to complete her undergraduate degree and to gain access to and participate in graduate school. The importance that her family places on financial austerity is a value that she describes as particularly relevant to her graduate school experience: she not only felt comfortable applying to graduate school because she did not have debt from her undergraduate degree, but also was able to go through her program without taking on additional debt because she knew how to be frugal. In addition to the value that she and her family place on managing money, Elizabeth attributes her application to graduate school to her parents' tangible support during her undergraduate program and suggests their assistance in providing transportation, housing, and meals during graduate school has contributed to her persisting in her program despite the logistical challenges that she experienced. In reflecting on her multiple sources of familial support, Elizabeth said:

One thing a huge thing is that my family paid for all of my undergrad tuition. My dad actually worked two full-time jobs to do that. My parents have always been debt adverse and very frugal, my dad particularly coming from his parents being an immigrant family. I definitely see that people have different outlooks on it. I was raised to be very frugal. To them, the concept of taking out tens to hundreds of thousands of dollars in loans was a very scary concept, and so, he just did everything his could. He felt responsible to make sure that we got a college education and along with that was doing whatever he could without taking on any debt. My grandparents, everyone on my dad's side, which is my family here locally, are immigrants: they're [Eastern European]. My grandparents' parents immigrated here. I think sometimes immigrants, especially when you come in with nothing, are very frugal and work really hard to save everything. I guess they lived through the depression. So, I sense that my grandparents who I grew up with never really left that mentality. So, I definitely inherited that, being frugal and have a strong work ethic. As graduate student, being frugal is a good asset. When I first came back to graduate school after being a full-time employee, and I knew my salary was drastically decreasing. I saw my lab mates going out and buying lunch every day, like sandwiches, but whatever you're buying is going to cost you \$7-\$10 per day. I was like, "You don't make enough money to buy lunch every day! You have to pack lunch." I think financially it's helped me through graduate school. Even last year when I commuted down here, I would even pack a lunch for a couple of days, bring enough food. Last semester, I moved to New York and then did this crazy thing where I came here once a week to teach a class. I couldn't have done that [without my family]. Half of those weeks I stayed more than one day and needed to stay overnight. I stayed overnight at my grandparents' house; they let me stay, fed me, let me shower. My parents would pick me up and drive me to the airport or pick me up or take me to the train station. If I came just for a day, I would do everything with public transportation. Even this last trip, my mom picked me up from campus, and I went home and ran some errands. My dad is going to drive me to airport this afternoon. So, without that it would have been impossible, or at least way more expensive; they've been really generous with their time and with going out of the way to help me.

In her narrative above, Elizabeth details multiple ways that her familial knowledge, values, and resources provided tangible support for her education. With regard to financial management, they not only instilled in her the importance of living within one's means but also modeled this value for her. In addition to teaching Elizabeth financial management and budgeting skills, which were important for her as a graduate student, her family supported her by cooking for her and providing her transportation, which not only served

as direct sources of support but also assisted in reducing her expenses and allowed her to continue to live within her financial means despite her logistical challenges in commuting. In the narrative below, she discusses how her family has provided emotional support and moral encouragement to her, which has also been integral to her success in her graduate STEM program. Elizabeth explained:

I think the values that she [my grandma] has and that my family has I take with me every day and know that they appreciate that I'm working hard. She'll say, "If only my parents could see where you are today!" For them it's a real success story because it's like the American dream. Her whole family immigrated from [Eastern Europe] and my grandparents grew up really poor. My grandpa was a car mechanic and the next generation was a mix; they went to college, but nobody was in STEM. Now, with me and my brother, we're both doing engineering. They definitely say things like, "Think how proud my parents would be to see how far the family has gone." I think about it through the female thing [a gender lens]. I think about the sacrifices that I've made compared to my husband. I owe it to them to be the best that I can and be the most successful I can be. If I get an award, my mom will tell my grandma, and then she'll tell my aunts; and they'll call me, and they'll ask about it when I come home. Whenever I've gotten awards or anything, they've made a really big deal out of it. They always call me. Actually, I got a card in the mail from aunt because one of my other aunts told her about an award I won. So, she sent me a card. They'll be really excited, saying, "We've heard about this new award you won." And it's usually just our salary. And that's just because our lab is really underwater, and my advisor will find scholarships to supplement our stipends. So, I'll be like "Oh this just my salary. It's not a huge deal." But they'll still be really excited about it. And my grandma will be like, "Oh, I told all my friends at church about it." They are excited about what I'm doing even though they don't understand it. They know when someone else recognizes it that I'm doing a good job. I appreciate it.

Despite their families being unfamiliar with the graduate school process, both Alma and Elizabeth's *testimonios* illustrate how their familial knowledge, values, and resources have served as important sources of support for them during their graduate STEM programs. They shared the challenges they experienced with their families who helped them in the ways they knew how. In the narrative below, Bianca describes how her mother has served as a role model to her through her strong work ethic and by embodying a

perspective that work is fulfilling, and productivity is positive. In sharing the ways in which her mother has served as a role model to her, Bianca noted:

I think about my mom a lot and how she came to this country. She was younger than a lot of her fellow students because they didn't have middle school where she came from, so she went straight from elementary school to high school and didn't know any English. So, she was sitting in classes and the teacher would call on her and she would just nod. And she said later with a little bit of laughter, "My friends thought I was a special student. They thought I had some delay because I wasn't speaking back to the teacher." She said, it was the Spanish teacher who realized that she wasn't dumb; she just didn't speak the language. So, she put her in a class with high school seniors learning Spanish, and they taught her English while she taught them Spanish. So, she was able to overcome that barrier and do really well. My dad talks about how she got better grades than him by far. She's been a hard-worker all her life. She goes into the office on weekends, and she would work way beyond 5 pm every night. So, I think it helped that that was the norm for me instead of thinking, "Oh, woe is me. I have to work so hard to keep up." Working on the weekends or working late at night just seemed like that is what you just had to do. It didn't seem extra hard. It didn't seem really frustrating to me to work long hour days because she [her mother] had set the example doing that her whole career. Even now, other graduate students complain about having to work on the weekend, and I'll text my mom and she'll say, "I'm getting a lot of work done today." And I'll say, "Yeah, I'm being productive too." So, I think that helped a lot, too. That's not to say that my dad didn't work as hard, but he definitely cut his work day off at 5 pm. As a writer, my dad always had to have things done early. So, it's just a different lifestyle, and he focused more on having fun and have friends than she did. I always thought my mom never does anything fun; she only works all the time. But, I think her work is fun for her, and her friends are her work colleagues. I think it was probably hard for her to make friends in our community because she had such a different background and had such a different life. But, I think just by setting examples. They didn't tell me the secret of persevering: they just did it by example in different ways and showed me.

Bianca recounts how mother has served as a role model for her: her mother's great work ethic and positive outlook are characteristics that she attempts to emulate during graduate school. While her classmates become overwhelmed with the amount of time their school work takes, Bianca explains how she did not become frustrated because of the example that her mother had set for her. Bianca said: "Working on the weekends or working late at

night just seemed like that is what you just had to do.” In her family, hard work was the norm.

In addition to serving as role models of good work ethic, Bianca’s family also provided her with moral encouragement by showing her how proud they were of her achievements. Bianca described how her grandfather was so proud of her that he would write letters to her grandmother to share her accomplishments with her after she had passed away. Although Bianca struggled to communicate with her grandmother due to their language barrier (and the fact that her grandmother passed away when Bianca was relatively young), her grandfather kept her connection to her grandmother alive through his letter writing. Bianca shared with great emotion:

This goes under the category of cheering me on, and I’m probably going to get teared up. I talked about how my grandfather worshipped grandmother on mom’s side. She was the mother of his eight children. She was a really strong woman. He watched over her late in life; he’s in his 90s, but he was still her primary caregiver. She had Alzheimer’s, and that was really hard for him. But he still kept up a good attitude about it: he was always smiling. But he took me aside one day when I was in middle school, and he showed me a book full of writing. He pointed at a picture of her that he kept at the kitchen table next to his notebook and said, “I still talk to your grandmother every day. I write to her, and I tell her about you.” He said something along the lines of, “She would have been really proud of you. I love telling her all of the amazing things that you’re doing. She loved you very much.” About her, she never learned English. She was really the primary reason I know as much Spanish as I do. I’m not fully fluent, but I really improved my Spanish. After she died, I felt so much loss not being able to speak with her. We could communicate non-verbally, pointing at things. I started taking lessons and stuff after she died. I tried really hard to learn the language and felt I lost the ability to communicate with her. But to have him say that he was writing to her after she died was really special. That was really inspiring to hear from him regardless of my beliefs about the afterlife. It was just really sweet that he was so proud of me that he was transcending death in order to tell me how proud he was, and she was. It was amazing how he didn’t say it with tears in his eyes. He was just so happy to be able to talk to her and have that connection with her. To this day, I still don’t know if he truly believed that he could actually speak to her. I know he wasn’t a very religious man, but he clearly saw the importance of that exercise. And thought to share it with us, his grandchildren. I don’t think I ever really read it [what he wrote].

But, I could see it, and I could see his nickname for her. If I was sitting next to him, sometimes, I could see the first few lines. He would just sit and stare at her picture and smile at it. His love for his family was really strong. I think he felt connected to her through his children and grandchildren. My mom was always most like her and took after her. So, I think he always had a special connection with my mom in that way. So, she's been a big role model for me. I feel like I look up to her and take after her more than my dad. I feel like I have a deeper bond with her. That I have taken after her, whether consciously or not, also makes me feel closer to grandmother even though we never really spoke to each other in a traditional sense. And the stories that she tells me about her. So yeah.

Bianca's emotional narrative highlights the significance that her family support has played throughout her life: her family's connection to one another is so strong that she could feel her grandmother's love and support for her despite their challenges in communicating with one another; and, her grandfather sought to maintain that connection even after her grandmother's death through his letter writing, which Bianca said has been a source of inspiration to her.

In the narrative below, Chelsea also discusses how her father's support has been crucial to her success in her graduate degree program. Although her father has neither a graduate degree nor a bachelor's degree in a STEM field, his work experience has provided Chelsea with necessary technical knowledge for her field. Chelsea shared that although her father's employment in internet technology (IT) did not play a role in her selecting a computer science graduate degree program, his knowledge about the mechanics of computers served as an important source of support during her graduate school program. Chelsea divulged:

So, I don't think my dad really influenced me, but it was really nice to have him at least kind of know what I was learning. I could call him, and be like, "hey what is this?" That was kind of cool. Even just like the first year here, I realized that I didn't know how a computer worked. I didn't know that the memory was different from disk storage. So, those are two different things. I didn't know what made up a computer, and that's what my dad knows because he's IT. So, he probably knows that more than some other people in my classes. As far as computer specs, I

remember my first semester here I called him to get some clarification on that because that was being mentioned in my classes over and over just casually. It wasn't the subject of my classes but things that were just off-hand mentioned stuff about memory or storage.

Although Chelsea's father was not educated in the computer science field, the knowledge that he gained through his employment in the IT sector was directly related to what she was learning in her graduate degree program and a helpful source of information for her: he was able to explain some the mechanics of a computer to her (such as the difference between computer memory and disk storage) that she was unfamiliar with as a new computer science student since she completed her bachelor's degree in a different field.

Navigational Capital: Support in Graduate School

As mentioned in an earlier chapter, Yosso (2005) suggests the familial and social skills and resources that constitute navigational capital are assets for students that help them to maneuver through hostile institutions. DiNicolo et al. (2015) expand Yosso's (2005) concept of navigational capital to include "resilience developed in familial knowledge," and the women's *testimonios* from this study illustrate how they use their familial knowledge to create perspectives that guide them through the challenges that they encounter in their graduate STEM programs (p.10). In discussing her family background and context, Bianca shares how her home culture has provided her with an attitude of gratitude that has been helpful to her successfully overcoming the challenges that she has encountered in her STEM program. Bianca proclaimed with enthusiasm and energy:

I would go visit my family, and they live in a third world country where there is violence, and there's a lot of drug trade. Early on, I sort of gained this perspective that I'm lucky to be here, and I'm lucky to be getting an education and just the gratitude that came along with that and gratitude for the city that I'm in. You know, I'm not constantly comparing everything to an ivy league or comparing everything to the best city in the country or whatever. And I feel like some people can get distracted by those sort of things and always thinking that there is something better

or that they're not getting their full value or like their full experience or something. I think that gratitude is definitely a coping mechanism like just kind of realizing how awesome it is that we get to get paid to do what we do and get to get paid to travel. And that I get to interact with all these amazingly bright people. And I have the resources that I do: I have lab equipment that I have access to, and I have data that I have access to. I've seen the other side when a country's government won't fund it, and you have to scrape by. And there is only one professor teaching everyone in the program. So, I think that has definitely helped me to get by in certain ways. You know, whenever I feel like I'm getting a chip on my shoulder just sort of reminding myself of my roots and how not everybody my family or in this generation of my family or previous generations had similar opportunities. And there's the immigrant mentality, which is just like working really hard and that your worth comes from how hard you work. It doesn't matter where you start off; it's how hard you work. So, I think that helps me too.

Bianca explains how her family's experiences encourage her not only to have aspirations for but also to take action to pursue a doctoral degree and to persist through challenging times. When confronted with challenges in her program, Bianca compares her experiences to her family's experiences in Latin America: this comparative analysis serves as a coping mechanism for her, which helps her to manage the stress of graduate school. Although not included as part of Khan's (2013) discussion of coping and academic performance, Bianca's comparative analysis could fit within the category of "positive coping methods" that students employ to persist in college (p. 8). In recognizing the opportunities and advantages available to her, especially in comparison to her family in Latin America, Bianca has adopted an attitude of gratitude, which has helped her to both put her grievances and challenges in perspective and persevere in her graduate studies.

For Daniela, on the other hand, her upbringing serves as a negative example and cautionary tale from which she draws values and experiential knowledge that she applies during her graduate program; she explains that having life totally disconnected from her studies has been important for her well-being in graduate school. Daniela attributes her perseverance in her program to having this perspective, which she explains she gained from

mother's cautionary mental health experience and advice, as well as her own brush with burn out early in her graduate career. In sharing this perspective, Daniela said:

My mom always tells me to take care of myself. I think that's also helpful is that my mom has always been more interested in my well-being. Of course, she's proud of me. And they talk about me all the time. It's kind of obnoxious. I mean, I get it, and it makes me feel good if they're proud of me. Maybe now that my imposter syndrome is a little better, it probably will bug me a little less. But, yeah, she's always been more concerned. So, I think that's also been good. She's never like "you're not doing enough." Even though growing up really sucked, I think because of that my mom really gets that like other crap happens, you know? And that work, and your career is, at the end of the day, not what keeps you going, you know? Like not even two years before she was institutionalized, she was given a huge teaching award. So, I think she really gets how if you make your whole life your career or if you make your whole life school, it can easily go down the drain. And if you have nothing, if you haven't cultivated love, friendships, and hobbies, you can wake up just like totally empty and with nothing. That happened to me once at the end of that fall semester when I almost died [burned out]. They luckily didn't have any winter courses, so I had to take time, well I had to work, but I had to take off – I had made my life school, and I didn't know who I was. I just woke up, and I didn't know what to do with myself. I don't have any hobbies, and I was like I don't know what to do with my day. And it was the most terrifying, almost like out of body [experience], and I didn't feel like a person. So, that's what kind of started that, you know? And my mom gets that. So, I know that's really unique. I know a lot of people from my background; their parents don't have degrees, and so, I think definitely my mom instilled in me my education. But also, like that's not the most important thing, you know? It's family and having a life and stuff, you know? Yeah.

I have another life. And I feel like, especially in STEM, science is supposed to be your life. That's supposed to be number one. You're supposed to be working all the time even on your free time; you're supposed to be reading science stuff. I am definitely not that person. In my undergraduate, there were these really passionate women who were in the marine ecology program. Even now, I couldn't really tell you the big names in organic chemistry, and maybe that's bad. I don't know, but that's how these girls were; they knew all the big people in the field, and who was presenting, and had *Silent Spring* in their backpack. This is just a job for me. When I go home, do you know what I want to do? I want to spend time with my husband and my friends, and I want to read fantasy books, play video games, and not think about school at all. That's really weird for STEM people. I don't want to hang out with science people. I love them, and I think I offended one of my lab members. I think that they take me too literally, it's not that I hate hanging out with them. It's just that I'm not used to that. I have another life. My life isn't science, and that's made graduate school possible. Because graduate school is overwhelming and a time suck and stressful even under the best circumstances. I don't think I would have gotten through last year if that wasn't a part about me.

Both of the narratives above provide examples of how underrepresented minority and first-generation graduate students use their familial knowledge and experiences to create perspectives with which they use to navigate the challenges that they encounter in graduate school. For Bianca, the challenges she experiences in her graduate program seem minor in comparison to the obstacles that her family experiences in Latin America, and as such, she finds both gratitude and possibility in the opportunities available to her. For Daniela, her mother's mental health crisis serves as a warning to her and encourages her to develop a more holistic perspective that includes a focus on her well-being in addition to her academics. Although Bianca and Daniela's perspectives are polar opposites, both serve as a way for them to confront the challenges and manage the stress of their graduate programs.

Linguistic Capital and Funds of Knowledge in Graduate School

In addition to familial and navigational capital, the women discussed the roles that linguistic capital play in their graduate school experience. Their *testimonios* show the multifunctionality of linguistic capital: for Bianca, her linguistic capital itself is one of the assets in her funds of knowledge that has been helpful to her success in her STEM program, and for Alma, it's an example of resistant capital.

Linguistic capital is a support that Bianca identifies when suggesting that Spanish language skills themselves are valuable assets that have helped her to learn programming languages. Looking at bilingualism through the lens through the lens of community cultural wealth, it is an asset to students in STEM fields, as explained by Bianca below. In her narrative, Bianca, who speaks both English and Spanish, describes how she learned programming languages easily and examines how her bilingualism may have been helpful

to her academic pursuits in her STEM discipline and her performance in computer science classes. In discussing her Spanish language skills, Bianca said:

One thing that I've always wondered is if the fact that I learned a second language early on has helped me in -- you know in talking about diversity -- picking up coding languages. For example, I always felt for me, it was the easiest, but some of my peers who I thought were very smart and picked up things quickly really struggled with this. I found this to be pretty facile. Even just the language that science is in, you know, there's a lot of jargon. There's a lot of papers that are written a lot of different ways even in subfields – even within my small field. So, I wonder if that's something that has been helpful to me; something that has helped me a little bit. I think that my mother would talk about it terms of my high school education, you know, just that I was good at vocabulary. My dad was a writer, but that I could just hear words, and I had a really large vocabulary even as a small child. She thought that just knowing the Latin roots of things, she went to school in America since she was 12 and so, she found she was able to pick up words early on. And I kind of connected that because a lot of sciences are written in Latin roots. So, I'll tell her some jargon from my work, and she'll say, "Oh, that's actually a word in Spanish." So, I think from conversations with my mother that I kind of guessed at that. And then I guess I was trying to understand, you know, why is it that I feel coding languages are easy to pick up. Well, I guess it's a very simplified language, and you have building blocks in your brain for how language works, then it's a little easier for you to stack onto it. I would guess that if I went back and told any of my mentors that I did research with I didn't know the language whatsoever going into the program that they might be surprised because I was able to pick it up so quickly. But, I wasn't really trying to tell them that I was like starting from square one. But, I do remember being shocked by the differences between my classmates and I in computer science classes. It was more like peer reinforcement when they said, "Oh, [Bianca] is really good" or "Let's ask [Bianca] the answers."

Although Bianca's narrative indicates how her Spanish language skills were essential to her in learning the required programming languages during her STEM program, she shares that she was reluctant to divulge that she was unfamiliar with programming languages prior to her taking this course. In addition to being linguistic capital, Bianca's Spanish language skills are an example of her funds of knowledge, or the familial or cultural knowledge and skills that she brought with her to the classroom, which Yosso (2005) includes as part of familial capital. Although Bianca did not recognize it at the time, she subconsciously

applied her language skills to understand new computer programming languages. Her Spanish language skills served as an important support for her during her STEM program.

Alma provides yet another example of the role that linguistic capital can play: it can serve as a component of resistant capital. Alma describes how her difficult working relationship with her advisor deteriorated when he neglected to inform her until the last minute that he did not have funding available for her. As an international student, she explains that without funding she would have been unable to continue her doctoral studies. Alma notes how her multilingual skills were an asset that she could have capitalized on to acquire funding for herself either by teaching or tutoring. At the same time, her language skills served as an element of resistance. By presenting her language skills as an alternative means of work and opportunity for funding, Alma exemplifies Yosso's (2005) resistant capital: her language skills enabled her to "engage in behaviours and maintain attitudes that challenge the status quo" (p. 81). In the narrative below, Alma explains how her language skills enabled her to gain agency in a situation in which she might not have had otherwise due to the power imbalance between her and her advisor. In detailing how her language skills provided her with power to resist her advisor's loss of funding and remain in her graduate program, Alma remarked:

Eventually, he [her previous advisor] ran out of funding and didn't even tell me, and the deadline to apply for a TAship had passed. And I went and like basically begged the department. And because I was one of the best students, and I was initially admitted on scholarship, they actually wanted to retain me. So, they did an exception. At first, they gave me half TA, and then eventually, they increased it to full TA. It was ok. But half TA, that's like \$350 bi-weekly, so, you know, it doesn't even pay my rent. So, yeah, for two weeks that's what I thought I had. Then, eventually they were able to upgrade me to a full TA, and I went to talk to him and said "I'm an international student. If I don't have money, I have to go back home; I can't afford to be here. And the reason I came to DMV University is because I can't afford to pay tuition or anything." And he said, "Yeah, I don't know, well, blah, blah, blah, we'll play it by ear." And I just really didn't like his answer. And

actually, my department has a policy that you can only TA a certain number of times; and when that was running out for me, I went, and I applied for various graduate assistantships around campus. But, I didn't get any answer back. I thought: I will teach Arabic and French; I can speak both natively. Something. Whatever. I'll work at the library. Just something.

The narratives highlight the various roles that linguistic capital play: Alma's bilingual capabilities provided her both with a means to resist her loss of funding and an opportunity to exercise agency in finding another assistantship on campus, and Bianca's Spanish language skills were the funds of knowledge that she capitalized on when learning the complex terminology for her STEM program. Although linguistic capital serves different purposes for each woman, it is an asset to both.

In addition to Bianca's Spanish language skills, which are both linguistic capital and part of her funds of knowledge, she mentioned money management skills, which is something that she learned from her family knowledge. Bianca shared how her grandmother passed down the wisdom of managing money through the generations of women in her family and describes how it has been useful for her during graduate school. In her *testimonio*, Bianca details the multiple ways that she saves money: she saves food; she walks instead of drives; she wears second hand clothing; and she improvises in making household repairs instead of buying new things. By employing these strategies, Bianca is able to manage money herself instead of borrowing from others. She follows her mother's advice of "*cuentas claras, amistades largas*" or clear accounts mean long friendships. Bianca reflected on the ways in which she uses the knowledge and skills passed down in her family to manage her money in graduate school:

A lot of the wisdom was about keeping the house because [my grandmother] was a stay at home mother and didn't have real [formal] education or anything. So, the kind of things [my mother] tells me about her have to do with money and raising a big family and keeping the house clean. The reason that she was so frugal was that

her mother was 20 years younger than her father. By her, I mean my grandmother's parents. They owned a general store, and her friends would come and gossip with her, and she was such a giving and generous lady. When people would tell her that they had fallen upon hard times, she would say, "Oh, why don't you just take this bread?" She would just give away their stock, so my great grandfather didn't trust her to run the store, but he trusted my grandmother who was seven years old. She would manage the cash box and would take it to the bank. She was this little girl dealing with all this money and keeping records. My mom is that way too. That's been really helpful in grad school, too. It's the reason I don't drive and the reason that I live the way I have. I try and walk as much as I can or take public transportation. That has to do with my mom and by extension my grandma. My friends make fun of me for it; that I always try to find an alternative to spending money. Once, we lost a coffee filter in undergrad. Instead of buying a new one online, I made one out of an old macaroni and cheese container. I cut a hole in the bottom, and it worked as a coffee filter. And we didn't have to pay anything for it. My friend always makes fun of me because I never eat a full meal: I always take it home. She'll give me her old stale food that she doesn't want to eat anymore. I never say no to anything that anyone is giving away. I'll always take it. Hand me down clothes that my friends want to donate, I'll take them. But, it's been really helpful; I've been able to lead a comfortable life in grad school

Concluding Thoughts

This chapter has shown how various forms of community cultural wealth (including funds of knowledge) have been important to the women at multiple points of their experience in higher education: completing their undergraduate degree, applying and gaining access to graduate school, and in successfully handling the challenges that they have encountered during their graduate degree programs. As first-generation graduate students, the women's parents had expectations for their daughters to go to college and were able to offer them some concrete advice about the application process and college experience; however, the women all reported that their parents could not offer the same guidance for graduate school.

Although their parents could not provide specific guidance about the graduate school application process or experience, the women all indicated that their families assisted them in other ways. For Alma, this support included aspirations for her future and

a willingness to help her achieve her dreams and goals even to their own detriment; a strong extended familial support system made up of people on whom she could always depend to share their time, energy, and trust with her; and language skills that served as an asset to her in resisting her loss of funding and in exercising agency to remain in the program. For Bianca, her family not only instilled in her values that encouraged her to pursue higher education but also modeled the hard work required to successfully complete her undergraduate degree and persist in her graduate degree program. In addition to serving as role models for her, Bianca's family provided her with the foundation for learning languages, which she applied when learning programming languages, and a perspective of appreciation that served as a coping mechanism for her when navigating the challenges that she experienced in graduate school. Chelsea's parents also served as role models for her: their hard work and dedication to their children provided Chelsea with a better life. In addition, Chelsea credits her mother with motivating her to apply to graduate school and acknowledges how technical information from her father's work has been important to her when learning about more advanced theoretical concepts in her program. Although Daniela's family relationships and upbringing have been complicated, her childhood experiences not only provided her with a foundational interest in her STEM field but also served as a cautionary example that reminds her to prioritize her own well-being and encourages her to maintain a work-life balance. This focus has allowed her to manage stress and not become overwhelmed when confronted with challenges in graduate school. In addition to providing her with tangible and moral support during graduate school, Elizabeth's family introduced her to her STEM field, and her father facilitated her access to a professional network in her field through his social connections at work. The deep

personal accounts presented in this chapter give evidence of how these multiple sources of community cultural wealth have been assets to first-generation women graduate students during various points of time during in their academic careers and have contributed to their success in various STEM fields.

CHAPTER FIVE: FORMAL AND INFORMAL SOURCES OF SUPPORT IN THE INSTITUTIONAL CULTURE

Introduction

In addition to investigating the extent to which familial or cultural factors have supported the success of underrepresented minority and first-generation women graduate students, I examined what institutional factors the women students identified as having contributed to their graduating from their STEM undergraduate programs and moving into graduate degree programs in STEM. In our conversations, the women spoke about important resources available for them in accessing college, persisting through their undergraduate degree programs, accessing graduate school, and persevering in their graduate programs. This chapter presents excerpts from the women's *testimonios* in which they discussed these institutional supports.

Formal Support for Accessing STEM Graduate Programs

As first-generation graduate students, the women indicated that at least one of their parents had a college degree but neither parent had degree in a STEM field. As discussed in the last chapter, the women's families had expectations that they would attend college and get bachelor's degrees; however, the extent to which they could provide guidance about the application process or college experience varied. For example, although Bianca's parents both went to college, they did not study a STEM field, so they did not have insight into what her coursework would be like. In addition, Bianca and her family lived in a rural town in middle America, so it was difficult for them to take her to visit any universities during her college application process. During our conversation about this process, Bianca indicated that her participation in the Minority Introduction to Engineering and Science program during high school was her only opportunity to visit a university campus before

attending her own undergraduate university. Bianca reflected on the ways in which this summer program provided her with an orientation to both the college experience and STEM coursework. In conveying the importance of this program to her and her gratitude for it, Bianca said:

I did a program between my junior and senior year [of high school]. They call it Minority Introduction to Engineering and Science, so we got a mini-semester at a really high-ranking institution that had great professors. We took entrance exams, and they placed us into classes right for our level. They took us through what a normal semester would look like except that it was accelerated for six weeks during summer. So, we took humanities and coding, math, and physics. It was really useful to learn what a TA was, and we had to learn how college works before going. My parents had both gone to college but not in STEM, so it was very different. We had workshops. We had recitations. All these words I didn't know, or I wouldn't have known until I came to undergrad. So, that was useful in learning how that worked. So, that was my visit. I only went to that one school. I didn't have to pay for it other than getting myself there. I'm pretty sure it was free. My dad will always say that I was so lucky to travel and do all these things. Similarly, I was in music, so I got to go to Europe and travel with other musicians in [home state] and play for different audiences there. It was on a discounted rate. So, I think he was always proud but also saw how far you can get with the right kind of support. Whereas he felt that he never got that, but he was really happy that I did. So, in that way, he taught me gratitude for the resources that I had access to. And to utilize them. He would say, "Look where I ended up, and I know you can end up in a lot better position. You're going to be a millionaire, and you're going to be supporting me when I'm old." So, encouraging me to ride that catapult and not waste those opportunities. Not that he wasn't a successful person, but in his eyes, he was just a writer in a Podunk town, and he could have been doing so much more if he had had that guidance. So, he always tried to make sure I had that guidance, and he always taught me to be grateful for having it.

Bianca and her father both clearly recognized the value of this resource. Bianca described this program as "useful" for introducing her to the terminology and habitus of undergraduate STEM programs. However, when looking at this opportunity from her father's vantage point, Bianca could see that it was more than "useful:" rather, it was an extraordinary opportunity for social mobility. Bianca explained how her father "saw how far you can get with the right kind of support" and with this perspective, he not only

instilled in her gratitude for this opportunity but also encouraged her to take advantage of the resources available to her.

For Daniela, the institutional resources available to her were much more than “useful” or an opportunity for greater social mobility. When discussing the trajectory that she took to get to graduate school, Daniela attributed her access to each consecutive point of her academic career to an institutional resource: while attending community college, one of her professors told her about the Bridges to Baccalaureate Program (Bridge Program), which provided her with access to a four-year institution, then through that program, she learned about the Maximizing Access to Research Careers (MARC) program, which provided essential guidance for accessing graduate school. Daniela discussed the institutional supports she received with great emotion:

I started in biology. I thought I wanted to be a marine ecologist, and actually, I didn't think I could go to grad school at first because I didn't have enough money to pay for a master's degree. I didn't think I would ever be able to quit my job to get research experience, and I couldn't just not work. I went part-time for two years because I almost killed myself trying to get a 4.0 and work at the same time. Not like literally, I was just not sleeping and stuff, so I had to go part-time for a while. But there was no way I'd ever be able to get the research experience to go straight to a PhD because you have to pay for a master's a lot of the time. But I wasn't really informed about anything. But then, one of my college professors, one of the first ones who noticed me, told me about the Bridge Program when I was at community college. So, he told me about that, and I got involved in that and did a summer REU [Research Experience for Undergraduates] with the Bridge Program where they let me pick the lab. And it was a seagrass ecology lab, and I had to work full-time during the weekend at Starbucks and full-time during the week doing research. But, I mean, it was like somebody was saying you need to do your research, so I did it anyway. And then I didn't do anything for a year after that because I was too busy working and trying to do classes. And the next summer, I contacted the same professor, and I volunteered; and then I continued volunteering. And then, the next year, he offered me a job as his lab manager. And then I applied to MARC [Maximizing Access to Research Careers], which is like the next step in the Bridge Program. So, the Bridge Program is to get you from community college to a four-year, and then after that, MARC is to fund you for two years to do your own independent research project, so then you go straight into a PhD program. So, they

don't only fund you to do your own research and pay you a stipend, but they also send you to conferences; they pay for your GREs; they have PhD panels that come; they have personal statement workshops. If it wasn't for them, the Bridge and MARC people, I literally would not be where I am. That program. Yeah. They really made it possible for me. Yeah. But, I mean, not a lot of people know about them. It was just a stroke of luck. He [the professor] just saw something in me, I guess. I should thank him. They [The Bridge and MARC programs] were horribly advertised. They were almost not advertised. It's my biggest complaint about all of these programs that I just got lucky. I don't know what stood out to that teacher besides doing really well in his course and asking questions. I never had long conversations with him or anything. I'm sure I wasn't the only minority student. I really have no idea. I really don't. Until this day, all of the programs that I have been a part of have been word of mouth. Just through people. Nothing is advertised. Unless you have time to not work and spend all this time to figure it out, I don't know how people do it.

Daniela shares how she went from community college to her bachelor's degree and then to graduate school because of the support that she received from various institutional resources. Although Daniela suggests, "I literally would not be where I am" without the institutional resources that she participated in, she shared that she only learned about them from one of her community college professors. In fact, she considers herself "lucky" for having learned about them by chance from this dedicated educator who was invested in his students' future.

Daniela also credits her successful application process to graduate studies to the substantial support that she received from the Bridge and MARC Programs. The Bridge Program helps community college students in STEM fields transition to a bachelor's degree program at a four-year institution, and the MARC program assists underrepresented minority students in preparing to apply to doctoral programs in STEM fields. In detailing the support that she received from both programs, Daniela said:

Jennifer [the coordinator of the Bridge Program] ran the Bridge Program, and she worked with all of us. She also taught the bioethics course. After the Bridge Program you had to take a course in the fall and spring semester, and only after that

would they consider applicants for the fellowship. So, she taught the course for that fall. Then, for the MARC students, she teaches a graduate application course. It's a course on how to write personal statements, Research statements; we edited each other's work and all that stuff. So, it's technically in her job description, but she definitely didn't have to go over all of that. She helped with everything not just the writing. She helped me figure out all of the applications. She's just the most wonderful woman. I don't know how she finds time for it. And she has kids and takes them to swimming and soccer practice. Her husband is also a part of the program too. He's a scientist at the same university. If there are angels on earth, they are definitely some of them. And she says it all the time, "I totally don't mind my work. I love these kids. One of the reasons that I love my job, and I don't mind working is that you guys appreciate the work." What I think she means is unlike the rich bratty kids. I mean, not all of them are like that, but that is one of the reasons why she went into it and worked specifically with community college kids. I guess we appreciate it more. I definitely do. I definitely see that among my peers. They [rich bratty kids] don't have the sense of awe and surrealism that I do. Where I am now I thought was totally unreachable when I was growing up. It feels surreal to me sometimes. I don't know how to explain it: a lot of kids grow up knowing they're going to take this path, and it's totally normal for them because it's just what people do. But, it's just not for me and a lot of these kids, and it's just out of this world. But, yeah, she's great.

Daniela's narrative shows the importance of the personal contact and mentoring that she received from her professor and Jennifer, the coordinator of the Bridge program whose dedication to and support for her students, as Daniela described, went above and beyond her professional duties; without her professor's knowledge of resources available and without Jennifer's investment of time, energy, and emotion, Daniela would have missed the opportunity to access invaluable support. However, Daniela's narrative also highlights a lack of broader institutional guidance: these support systems are established institutional partnerships for underrepresented minority students, but Daniela only learned about them through a conversation with her professor.

Like Daniela, Elizabeth received important information about academic and professional advancement from one professor. Elizabeth said, she had not considered going to graduate school before one of her professors emailed her to inquire about her

future plans. In discussing why she decided to pursue graduate studies in her STEM field, Elizabeth recalled:

I think my advisor emailed me. He was my undergraduate professor at that point. And, at that point, I think I was a senior, so it was already too late to apply. He had reached out to me when I was an undergrad in his class about interest in graduate school.

In the email that Elizabeth received from her professor, he asked what her post-graduation plans were and suggested that she should consider graduate school. He spoke highly of her performance in classes and indicated that he noticed that she had a strong understanding of the material. He told Elizabeth that he would be delighted to write her a reference letter supporting her candidacy.

In offering her advice, he explained that graduate school would not be like her experience during her undergraduate program: it would require substantially more time and focus. For those reasons, he discouraged her from working full-time and going to graduate school part-time; he encouraged her to become a full-time graduate student in the subfield in which she was most interested. The professor also suggested that she speak with other professionals working in the field, so she could get a sense of their daily responsibilities and activities. He did not want her to have any false hopes about the work that her research might involve.

Although the stories of support depicted by both Daniela and Elizabeth provide encouraging characterizations of engaged educator-mentors to whom they attribute the furthering of their academic and professional careers, these stories also infer simultaneously discouraging accounts about the lack of broader institutional guidance available to first-generation graduate students. Daniela only heard about an established institutional partnership designed to support student retention and persistence from one

professor and then considered herself “lucky” to have even been given this information; and Elizabeth only learned about the possibility of graduate school from one professor when it was already too late to apply. Both Daniela and Elizabeth attribute their access to graduate school directly to the supports that they received from faculty members at their undergraduate institutions; however, the fact that they were not aware of their entitlement to these resources is disheartening.

Bianca was also unaware of the process for applying to graduate school, and like Daniela and Elizabeth, she found support through the social connections she made at her undergraduate university. During her undergraduate degree, Bianca’s professor was the first person to explain to her that it was possible for graduate students to receive funding for graduate school. In addition to her professor, Bianca met a classmate who along with her classmate’s father was instrumental to her completing her application and being accepted in graduate school. Bianca admitted that without the information that she learned from this social capital, she would have been unable to apply to graduate school. In recalling the story of her graduate school application process, Bianca remembered:

I remember one day sitting with professor in my department saying, “Well I’m not sure if I’ll be able to afford grad school.” And this was my sophomore year. And he was like, “No! Who told you that you’d have to pay? You don’t have to pay. You can get funding, and you’ll get a stipend.” I had no idea. So, I felt like very alone in that process. I sort of latched onto one friend that she was applying as well, and her father had gone to grad school, so I ended up gaining some wisdom from him. Her father, he actually sat me down and helped me choose from the schools I was looking at. He told me how to look at the metrics of a good research program. I was able to have a conversation with him, and he was in Pakistan, so this was all the way from Pakistan that he was helping me. She ended up sharing GRE study materials with me, so I got really lucky to have a friend that I could learn from who knew the drill whereas my parents had no idea what I was going through or that I was trying to apply to all these schools while at the same time I was trying to do my studies. Other than that, our department didn’t give us a lot of support. There were no talks on how to apply to grad school. There was only one PowerPoint presentation, but it was dated from like five years earlier. There were no panels or

anything that we could have asked questions at, so you had to go on your own to find things.

Similar to Daniela and Elizabeth, Bianca considers herself “lucky” to have met a friend from whom she could learn the requirements for and process of applying to graduate school. Although Bianca’s *testimonio* includes an illustrative example of how the university provides students with an opportunity to expand their social networks, and therefore social capital, the fact that she learned about and received support for applying to graduate school through her informal social network rather than through organized institutional resources is problematic. Furthermore, Bianca adds that, to her knowledge, no institutional supports were available for her to learn about graduate school on her undergraduate campus. As a first-generation graduate student, she had to not only take the initiative but also find the information herself.

The narratives contained in this section highlight how the university is a place where students can develop influential social connections with both professors and other students from whom they become aware of and through whom they gain access to resources. For Bianca, Daniela, and Elizabeth, first-generation graduate students, these connections were integral to them learning about and successfully applying to graduate school. Although the support that Daniela received was through established institutional resources, she, like Daniela and Elizabeth, only learned about their existence from a conversation with a professor.

Informal Resources and Networks in Graduate School

When determining which university to attend for graduate school or describing their experiences at DMV University, the women discussed the importance of institutional culture. In her narrative below, Bianca depicts the diversity that she saw on campus and

indicates that it was a factor that encouraged her to select DMV for graduate school. Bianca shared:

There was a professor here that was Latino and had a very visible accent and a visible name and was still very successful, and everyone spoke very highly of him. I think it was helpful that there was a female professor here too. I think that encouraged me too because other programs that I visited that didn't really have any role models like that. That too I think was part of the reason that I chose this particular program. I could find some allies in that community not only in students but also in the faculty. The student body is very diverse. So, I came from a private school that did a lot of recruiting abroad, and so, I got an experience going from my rural town to that was about 50% Hispanic and 50% white to a whole bunch of different cultures from all different continents and students from every state; they really tried to get a lot of different students going there. And it was a small school, so there was a lot of one on one interactions, so I learned a lot about Indian culture, Chinese culture, Malaysian culture, different cultures in Africa like Nigeria and Ethiopia, and I was part of a global scholarship program where they encouraged us to have conversations with all these students being from different parts of the state and everywhere else. So, that was really important to me in a grad program and what I was saying is that a lot of the grad programs that I visited had a very homogenous population; it was kind of an isolated population. All of the students had similar experiences because they were coming from same state or region and going to the state school, but when I came to DMV, it just struck me how there was a lot of representation in the students I saw skateboarding past or bike riding past. I think I asked about it, and there's a lot of students that are drawn to the [larger metropolitan area], and a lot of [international professionals] in the [larger metropolitan area]. There's a lot of cultural diversity, and so I didn't want to leave that behind because it was really important for my growth throughout college. So, that was something that was important, and it's still important to me that I have students in the classroom that don't just look one way. That's been really good to have dialogues on campus that come from different perspectives, and I've been able to sit in on some diversity centered talks and hear from students in different programs who represent a lot of different intersections of identities. I think that at least people that go to DMV really value those kinds of discussions and conversations. That was something that was sort of a magnet for me in coming here.

For Bianca, the apparent diversity of the student body and the faculty was an important factor that encouraged her to attend DMV University. She describes how the atmosphere of the university suggested that diversity was not only acceptable but also desirable. The visible diversity on the campus was one of the reasons that Bianca chose

DMV for graduate school. In addition to the diversity of the student body, the ethnic and gender diversity among the faculty in her graduate program was also an important factor in Bianca's decision to attend graduate school at DMV. Although Bianca was not acquainted with the professors, as a Latina woman entering her field as a new graduate student, simply having these "role models" was encouraging and "part of the reason that [she] chose this particular program."

Elizabeth also discussed the importance of role models to her experience in graduate school. These role models were the other women graduate students in her department with whom she rented a house. She explained how these women were an informal network of support for her. With these women, Elizabeth felt that she could share both the problems and prospects that she encountered as a woman in aerospace engineering. In highlighting the ways in which her housemates served as peer mentors and role models, Elizabeth noted:

I would say that meeting other female graduate students in my department and even other departments has been really important to me. Whether they are younger or older than me, they all serve as role models and reinforcements that we should be there. Last year, I lived with a group of five of us in a house, and four of us were female engineering graduate students; and it was really cool to have that support structure. We all baked and cooked and did things that were stereotypically female, but then we were in this graduate engineering program. It just made me feel more like I was supposed to be here; it was ok to be here and to also be female. When I lived with those women, I was in my fourth year then, and one of them was in long distance relationship as well, so that helped me to be able to relate to her. Knowing that we had the same situation where we were prioritizing our own career trajectories in addition to having our relationship. By then I was already in my fourth year of grad school. So, for the first three years, just making friends with all the girls in the program; I became friends with them. For example, there were three of us that won a national award for being leaders in aerospace, and all three of us were blonde females. So, that was cool. I also realized that people would look at that picture, and it would stand out. It was cool to meet them through that and to have them be the other people who were recognized. I was like, maybe there's a trend here with some other traits that we have. Maybe not necessarily just the fact

that we're female, but definitely that we brought something to that table that maybe people who were stereotypical engineers didn't have.

Elizabeth's *testimonio* shows how the other women in her program serve as "role models" and "reinforcements" for each other: their presence reaffirms both Elizabeth's feeling of belonging in the program and her sense of identity as a woman in aerospace engineering. With them, Elizabeth indicates that she feels empowered to be an aerospace engineering graduate student *and* a blonde woman who enjoys cooking, baking, and "other things that [are] stereotypically female." In the company of these women, Elizabeth is not only accepted for who she is but also validated. Like her, three of her colleagues are blonde women who engage in activities that stereotypical gender norms describe as feminine but also are national award-winning leaders in aerospace. The companionship of these women shows Elizabeth that she is not the single anomaly of a blonde feminine woman in aerospace engineering and helps to reaffirm that she can be equally as competent as other men in her field without needing to change her appearance or identity.

Bianca also found support in her friendship with another underrepresented minority woman in her STEM program. This woman provided guidance to her during her graduate school experience that was related to her professional development and to her ability to navigate the challenges that she encountered within the culture of her department. In her narrative below, Bianca describes the ways in which this woman served as a mentor to her:

I was lucky to find another woman in the department who I really got along with and who took me under her wing. She already had her master's but had been in the field quite a bit longer than I had and was quite a bit older just because she had taken time in between too; and she's also a woman of color. I wasn't expecting to find an outside mentor aside from my advisor who I could talk with about the things that I was too embarrassed to talk to my advisor or even the postdoc that I was also working with. She was really the one that encouraged me: she said if your professor isn't giving you the attention you need because he has too many students, you need

to fight for yourself and stand up for yourself and ask for these things. I think if she hadn't been there to tell me that I wouldn't have tried harder to further my career independently of him. So, I've been lucky with friends in that regard and in gaining these mentors along the way that just happened to be going through the same things but have a little more life experience in academia. I think that through conversations with this friend I realized and also readings: we send each other readings, and we have our own conversations; this also happen in the women's group. But this is just between the two of us, and she'll call out various students and faculty, which has helped me notice these things more. Because I have seen white privilege in my department. So, things that happened to her wouldn't necessarily happen to others. So, she's helped me be more aware and just the political climate in general has made me more aware of institutional racism and microaggressions, and I wouldn't have seen that as an undergraduate because I was not aware of what to look for or about these conversations.

By adopting her peer mentor's critical perspective, Bianca learned a new way to examine the culture of her department and her experience within it; with this new perspective, Bianca felt more empowered to take actions toward improving her own professional development. Although Bianca learned the terminology of institutional racism and microaggressions from attending the Women in STEM student organization in her department, the woman friend described above helped her to become more aware of the manifestations of these terms within her department. Bianca says that considers herself "lucky" to have this friendship and to have received the support that she needed. The appreciation that Bianca has for her friendship and the guidance she received is understandable; however, it also begs the question what would she have done if she had not been so "lucky" to find such a mentor on her own? From whom would she have received this guidance? What support would have been available to her?

Like Elizabeth and Bianca, Daniela found similar support from other women on campus; however, this support was not through women in her program, but rather one woman with an interest in diversity issues. Daniela explained that she often has difficulty relating to people in her program because her background and upbringing are so different

from theirs. However, she found support in her friend, Monica, who Daniela calls her “cheerleader.” In conveying both the challenges she has had in relating to other students and the support she has found in Monica, Daniela declared:

I don't relate to people as well. I mean I have friends, but still to this day, I don't know anyone who came from a background similar to mine--male or female. Maybe some of the international students, but if you're from India or China, you didn't come from a disadvantaged background. Probably not. I mean they all have nice clothes and tablets. They don't strike me as coming from a poor country site in India. And they all kind of keep to themselves anyway, unfortunately. I wish they didn't because I like to learn about other cultures. Even the people I'm friends with in my lab, on like a really deep level? Talking about how we grew up? No. I'm like I don't relate to any of this crap. Now that I have more friends like my friend Monica, she grew up the total opposite of me, but because she does diversity stuff, she's my cheerleader. So, I met her first semester. She really helped me not feel weird about that stuff. And now that I'm talking to more people, she's gotten me out of my shell to not feel weird about that, which I used to. I don't know why I would wish that the upbringing I had on anyone, but the need to relate to someone is so strong. I'm at a new place, and my husband and I don't know anyone. That need to relate, it kept me for a little while from making friends and then I met Monica, and then she really helped. But now, I don't have that problem as much. But, that summer in Woods Hole [when she was participating in a Research Experience for Undergraduates] and feeling that way. There's probably thousands of people like me. I was just lucky to find people like Monica. She's so amazing. She's one of those people where you can just talk. There are some people that you talk to and you complain about stuff, and they're like, “Well, I did this or I did that.” Even though she has no funding, I can bitch about stuff, and she doesn't care because she's so accepting that everybody has problems. Not only is she my no committee but also, she's my you're awesome committee. So, she has really helped me. And Priyal [another woman in her program]. This group of girls we all try to be really positive kind of to a ridiculous extent. We're like, “You're amazing and beautiful.” “No, you're amazing and beautiful.” It seems silly, but you really start to internalize that stuff. It started as a silly thing that we all started doing; but now, I'm like, “No, God damn it. I am a successful graduate student.” It made me realize over the last couple of months that everyone struggles in grad school. Grad school is hard for everyone. No one is like, “Grad school is a breeze. It was easy.” I think crucible. I love that word because I really think that's what graduate school is. It either makes you or breaks you. I hate that's the way it is. I'm hoping that changes at some point in the United States. But, it really is. Once I kind of got that in my head, I really felt like my first semester when I was TAing, and I wasn't really close to anyone, kind of how therapy helps you realize that you're not the only one who deals with this crap, I realized by meeting Monica and forcing myself to get an office there and talking to people, it comes off as, Daniela complains a lot. But, I'm trying to get people to talk and share. We all really have similar problems. Maybe

mine have been on a grander scale, but no one's trauma or pain is somehow less valid than another person's just because the magnitude is different. Everybody's suffering is valid and deserves to be dealt with and heard.

It is encouraging to hear when graduate students form friendships like Daniela's and Monica's on campus. Peer networks are an important resource for academic and social support that help all students to persist within their fields of study, especially at the graduate level where much of the work is individual and can be isolating. Daniela's sentiments are consistent with Palmer, Maramba, and Dancy's (2011) findings from their in-depth qualitative interviews with six undergraduate students, which suggest that peer groups are especially beneficial to the success of students of color in STEM disciplines: peer groups help to counter isolation by fostering collective learning, collaboration, inclusivity, and growth. Daniela's *testimonio* extends Palmer et al.'s (2011) findings to graduate students in highlighting how peer networks contribute to the well-being of underrepresented minority women in graduate STEM degree programs.

The connections that Elizabeth, Bianca, and Daniela describe are particularly important to women who self-identify as underrepresented minority and first-generation graduate students for whom the challenge of isolation may be triple: in addition to solitary academic work in their graduate STEM fields, they may feel isolated as a woman in a male dominated field and as an underrepresented minority student if their program lacks diversity. Daniela's narrative highlights this sentiment when she says, "I don't know anyone who came from a background similar to mine." Daniela echoes Bianca in sharing that she feels "lucky" to have found a friend like Monica who is interested in and supportive of diversity and inclusion. While the value of these friendships should not be understated, the need to have broader social support available through institutions for all students, but

especially for underrepresented minority and first-generation college or graduate students, is imperative.

Formal Resources and Networks in Graduate STEM programs

The women's perception of the availability and utility of departmental or field-specific diversity resources on DMV's campus varies. In her *testimonio*, Bianca discusses a program-specific weekly seminar that includes topics on diversity and inclusivity, which she explains has been helpful for her in navigating some of the challenges that she has experienced as a woman of color or a woman in her field. Bianca shared:

We have this seminar every week that is supposed to be a split between careers and diversity issues, so we have talks about alternative career paths and the stigma surrounding them. We have had talks about March for Science,² for example, and that's really been helpful for me to see it more critical as a field and a little more aware. I think it's been a little detrimental in that it takes up more of my head space that I could use to think about other things. But in a way too, I think that I'm less prone to feeling despair or hopelessness because well, I'm battling all these odds like this person has never had to deal with these things, but I've encountered them all as a woman of color or just a woman in general in the field.

Alma also discusses the importance of a STEM women's group in which she was involved, Women in Electrical and Computer Engineering (ECE). Like Bianca and Daniela, Alma shares that she has felt isolated in her program: she states that she "wasn't expecting that it was going to be so few women." She also mentions the cultural challenges that she has faced in being an international student. Alma has found both guidance and support through the Women in ECE group. In describing how this student organization provided her with a peer network of women students (mostly international students), Alma said:

² March for Science was a series of marches that took place in cities across the United States advocating for politics to stay out of science.

We actually had a Women in Electrical and Computer Engineering (ECE) group. It was really good. We used to have weekly lunches, and we'd get together because the department was sponsoring it. We would just talk about issues or differences between back home and here [cultural issues and differences for international students] or anything that we're facing. We've all kept in touch even though the core group that I became friends through that program has graduated. We had events and speakers come, and sometimes there were companies. Sometimes, companies would contact us to have special recruitment events because a lot of companies are trying to diversify who they hire. So, we had that. We also have a faculty advisor for the group who is a woman, and she would suggest a field trip somewhere. We once went to the botanical garden, and we went on ski trip. She once invited us for dinner at her house. So, just events like that and sometimes they're very spontaneously organized. Sometimes, we'd get funding from department for events. We designed tee-shirts. So, things like that.

But we also had a Big Sister-Little Sister program. So, when I came here, I was somebody's little sister; she checked on me before I came here and then throughout. She helped me to settle in. I became good friends with her, and I think this thing helped me a lot because when I first got here I wasn't expecting that it was going to be so few women. So, we talked a lot about that; we talked a lot about how a lot of the male students were upset that we were getting free lunch every week. They were like, "why isn't there a men in ECE group?" One of the girls actually answered a guy that said this in a very nice way, and I'll always remember it. She said, "We hope there comes a day when we don't have to have women in ECE. That's what we want actually that women don't need an extra support group." Yeah. So, I think that's how I feel about it. I think that men just think about it as an extra perk that we have whereas we think about it as a support group because we're lacking support. Because we feel whether we want to or not, when you're the only woman, you feel self-conscious, but also because you're the only woman, there's a lot of unconscious harassment that you're subject to. I know that men are not aware that they're doing this, but it's like "Just drop it already. You're not the only guy, and so there's been five people who said the same thing to me. I don't want to hear, "Oh you're the only girl! How does it feel to have all these guys?" Just constantly hearing these same things. Maybe they are harmless, but I think that they're not aware that's all we hear and that makes us feel like that's all we are: the only girl in the class because we've got to have one girl. I think that men just don't understand the need for this and that women feel like they're isolated in the field.

Although Alma downplays the importance of this group as "just a grad student group," she shares that it involves both faculty members and departmental staff. Given its comparison, the Women in ECE group offers a holistic model to address women's

isolation: the meetings provide women students with an opportunity to share their experiences and needs not only with each other but also with professionals on their campus. In addition to bringing students, faculty, and staff together, this student group also hosted events to increase men's awareness of and gain their support for women's issues in STEM fields.

It was just a grad student group. I mean basically whenever a woman joined the department we would email her and ask her if she wanted to be part of this group. Most people say yes because all it involves is being a part of a mailing list and attending events is optional, so it's pretty much all women in the department. And professors who have decided to be on the mailing list [not all of them have] are also there. So, sometimes they attend. And the staff of the department. We decided to include the staff and the faculty because we felt like if they became support systems for us, it was good for them to be aware of our issues and to raise them through policy and any changes to the department. So, it was important to know that. We also had an event that we called Women Plus Champion, and we could invite somebody with us: we could invite a male friend. So, we did this, especially after we heard that guys didn't understand why we had this program in the first place. So, it was kind of to bring awareness and see what we do at these events. And we also share the free lunch. And mostly to tell them what it is and to tell them what we experience, so they're aware of it. A lot of our issues as women happened because men are not aware that these are issues for us or that certain things do bother us. Yeah. Or just in general, so they can be general supports for classmates or friends.

For Alma, the Women in ECE group has been a very important space for her not only to share her experiences as a woman in the department but also to network with other women students, as well as faculty members and staff. The Women Plus Champion event also provided the women in electrical and computer engineering programs with an opportunity to engage their male counterparts in conversations about women's experiences in and concerns about the field. Integrating male students' voices into the discussion is integral to evaluating the experiences of and expectations for both genders in the program, and their involvement is especially pertinent since they suggested that they did not understand why this resource was only targeted toward women. This holistic design of

Women in ECE is essential for garnering the support needed to address and ameliorate women's issues within the program.

Alma also shared how the Women in ECE organization events illuminated existing gender issues and provided possible solutions to both the women students who attended and the faculty members in their departments. In the narrative below, Alma explains that from her membership in the group, she learned how the attribution of implicit stereotypes (e.g., praising women only for soft skills, such as communication and commending men for hard skills, such as quantifiable results or proficiency in software programs) in recommendation letters contributes to unconscious gender bias in university admissions decisions and employment offers. Alma shared this information with her advisor who was both appreciative and amenable to reflecting on his own actions. In recalling what she learned and how she approached her advisor with this new knowledge, Alma noted:

Sometimes, there are special outreach events for women; we then forward these things [among the members of the Women in ECE group]. Or if there's a Ted Talk that's interesting, sometimes we watch Ted Talks. There was a very eye-opening one that we watched. Maybe it wasn't a Ted Talk, maybe a YouTube video about something bias. I can't remember, but how people have an inherent bias toward women, even women have it. They did a lot of experiments where in admissions they made them [the applicants] gender neutral, and then they accepted more women. Or they flipped the genders [on the applications]. Also, another thing that this program made me actively aware of, and I have talked to advisor about it, is when a person is writing a recommendation for a woman, they tend to use soft qualities: "She's very agreeable to work with. She's nice." And it's just unconscious; it's not ill intentioned, but apparently, it's very common. For men they say, "He's an achiever. He's a decision maker." And it's less common to use them [these qualities] for women and more common to just judge the character rather than the work that the woman does. So, we had a speaker come to talk about this, and when I saw that, I talked to my advisor about it. I sent him the slides from the talk because I thought that it was important for him to know and to be aware of it when he's writing recommendation letters for students to try to use the same words as for men. Then, he said that he now will go back to look at a male letter of recommendation before writing one for a woman. That was actually very helpful, and it was through that program [Women in ECE]. He said, "This is every

interesting” Although he has the habit of putting numbers in his recommendation letters, for example, “Her algorithm achieves 98 percent accuracy.” He did notice that he tends to talk about more soft skills for women than for men. And he compensated by putting more work qualities for men. And he actually thanked me for that [bringing this issue to his attention].

The information and guidance that Alma received and then shared with her attentive advisor will improve the content of her recommendation letters and could have tangible effects on her career. Alma’s narrative suggests that the departmental resources available through the women in STEM organization and engaged faculty members provide women graduate students with advice that encourages them to develop agentic perspectives and enables them to take action.

Elizabeth has also sought guidance in graduate school through departmental resources. In her narrative below, she explains how the Women in Aeronautics and Astronautics (WIAA) group had panels of women guest speakers who served as visible examples that reassured Elizabeth of her identity as a woman in her field. In reflecting the first panel event that she attended, Elizabeth recalled:

The first event I ever went to as part of the Women in Aeronautics and Astronautics group was not event that I planned. So, it was planned by the founding board. It was so great: it was a panel event with women in the aerospace industry. I just remember there being at least two women on the panel who had PhDs, but one of them had blonde hair and highlights. She was the first woman that I had ever seen with a PhD who had highlights and had clothes that I liked. I could relate to what she looked like and how she came across as a person and that meant a lot to me. And I thought, “Wow! Maybe it’s ok if I want to keep highlighting my hair and dressing the way that I want.” So, I think maybe having that experience led me to becoming more involved in the group and organize more events like that in the future for my own benefit and to fulfill the needs of other students in the department.

Elizabeth describes how these visible examples of women role models working in her field encouraged her continued involvement and future leadership in her program. A guest speaker who came to the WIAA group shared insights about her own personal career

trajectory, and Elizabeth also received helpful advice from her department chair who was the first person to divulge the challenges that he experienced in balancing his dual career relationship. In relaying what she learned from both sources, Elizabeth said:

So, through the Women in Aeronautics and Astronautics group, there have been guest speakers from industry and one from academia: I think she was from Southern University, and she talked a little bit about what it was like to have a family and be a professor; but she worked in the industry while she had her family. Then after her kids were school age, that's when she came back to be a professor. So, I don't know if I have met any female professors, not that they don't exist, I just haven't met them, who have had kids in tenure. I know of male professors who have, but they have wives who work part-time or don't work at all. So, yeah. I would definitely love to meet those people if they exist. It definitely makes me worry how we, my husband and I, will work out the timing. This is a challenge of our generation, so people might not have figured that out yet. One thing that has helped me is that my department chair told me about his path and background; his wife has a PhD and is very active in STEM communities. He talked about how they balanced and went back and forth and would go to different cities for each other to support each other. So, that was helpful to hear how they did that.

As her graduation from her doctoral degree program approaches, Elizabeth, who is one partner of a dual career couple, has become concerned about how she and her husband will balance their careers and family. She received some helpful guidance from her department chair, who is also in a dual career relationship, and she learned about the career trajectory of one woman in the field who also has a family when she came as guest speaker at the WIAA group. Although these panel events and the network of women to whom Elizabeth became connected have inspired her throughout her program, she shared her disappointment about the lack of concrete guidance that she received from these events about managing the roles and responsibilities of being a woman who is in dual-career relationship and wants to have a family while growing professionally in her field. In analyzing the situation, it appears that the structures and resources for the kinds of

conversations that Elizabeth is requesting are available; however, they have not provided her with the targeted advice for which she had hoped, as she explains below.

So, we have a Women in Aeronautics and Astronautics group, which is supposed to foster community and these types of conversations between the female faculty and the undergraduates and graduates, but I think I've had maybe one conversation with one of the female faculty members in our department, but just one. My advisor doesn't have kids, so we can't talk about what that's like, and he's a man anyway. Yeah. So, it's not something that we've really ever had a talk about like how to be a successful faculty member and have a family, which is something I think would be important for both genders.

Alma and Elizabeth's disparate experiences with their departmental STEM resources highlight the differences in the levels of understanding of the support needed by and provided to women graduate students in each program. Alma speaks only favorably of the holistic design and resulting support that she received from the Women in Electrical and Computer Engineering organization whereas Elizabeth indicates that the Women in Aeronautics and Astronautics organization provided her with visible role models who encouraged her not only to persist in her program but also to take on leadership roles but, at the same time, left her searching for much needed guidance.

Elizabeth shared that she found the best guidance about maintaining a work-family balance and handling the challenges of her dual-career relationship through the informal social network of dual-career couples that she met through her husband's work. This peer network has dealt with similar challenges that Elizabeth and her husband have experienced or may encounter in the future. Although Elizabeth acknowledges that she and her peers "are still trying to figure it out," these friendships have become a social network and support to her. In conveying the importance of this peer network, Elizabeth said:

We have friends near us who are around the same age as us who are dual career couples. I think we're more aligned with our friends there than we were down here [near DMV]. [My husband's] best friend in residency's wife just started her own

physical therapy company; she's going to be the primary breadwinner. She's going to have her own physical therapy company by young females for athletic girls that helps them build confidence and be supportive of each other. So, that's been super cool seeing them go through that. They have a dog too, so they have to share responsibilities of taking care of the dog. I think it's good for my husband to see how much responsibility his friend takes. Before, I was really the primary caretaker for our dog. We lived with his cousins, and they're also our friends; they're a little bit older but in our generation. They both have dogs, and they are a dual career couple. They actually work at the same place, but they have to figure things out together. And his cousin who is a girl works more hours than the guy, and he's the more primary caretaker for the dog. He's the one that things fall to because she has to stay at work late, so that was cool to see. Pretty much all of [my husband's] co-residents, I remember when I first met them at a party when [my husband] joined the hospital meeting all of the significant others, one has PhD, and another is also a doctor. It's been cool to see these strong women and these dual career couples; it's pretty much the norm up there, so that definitely helps. I think we're all trying to figure it out together. I don't think any of them have it figured out.

Although Elizabeth felt that the resources in her STEM program did not provide her with explicit guidance about how to balance work as one partner of a dual-career couple or how to achieve a healthy work-family balance as a professional woman in her field with a family, she does indicate that multiple sources of support for professional development were available to her. In addition to the information that she received through guest speakers for the WIAA group, Elizabeth shared that she was selected to participate in the future faculty program, which she describes below.

Every year there is an announcement once per year, so I knew about it. And I had a friend from undergrad who was a year or two ahead of me. As soon as I was eligible, I applied. They accept two people from each engineering major, and I was one of the two from my year. It was a series of three one credit seminars and the first seminar focused generally on a career of a university professor and some of the things we could be doing now. The first class was about good practice for being a research professor. The next class was about teaching, so good teaching practices for engineering. And the third class was about the application process and getting application materials together.

The preparation that she received from the future faculty program appears to have been beneficial: Elizabeth was offered a faculty position. Elizabeth's STEM program offered her sufficient support relating to professional development; however, she is still looking for concrete guidance specific to gender-related issues.

University Formal Resources and Networks

Bianca indicated that she has also been in search of guidance during her graduate program: she shared that she has struggled both with the lack of diversity within her program and with her own identity issues. Although not specifically STEM related, Bianca found support in one of the resources available on DMV's campus: a Diversity Discussion Group for Graduate Students. A friend in Bianca's program recommended that she participate in some talk therapy or counseling, and when doing her own research on support resources available, Bianca saw the Diversity Discussion Group listed as a service offered on campus. When she went for a consultation at the counseling office, the counselor she spoke with recommended the Diversity Discussion group to her, rather than individual counseling, which the counselor said is more difficult to access. In explaining why she decided to attend the Diversity Discussion Group, Bianca said, "Hearing that it was led by another white-passing Latina convinced me to try it." Bianca reflected on how she learned about this resource and her reasons for participating in it in sharing:

I'm actually in a therapy group that is geared toward diversity issues and LGBT and people of color and disabilities and transgender and all these things that come up. So, that's really helped me assess my mental health from that perspective. I think that that has helped me get by day to day with all these feelings that I have and all this turmoil that I'm dealing with and just engaging with people that go through this program. I got to a point where it was right after the election, which took a lot out of me in general, and it was right around the time that my advisor told me that he was leaving the department and that I would have to find a new advisor, and all of these things that were colliding at the same time. And I was just frantically looking for something, and this same friend who mentored me and who encouraged

me to reach out and fend for myself like she had to do; she encouraged me to look into therapy as an option, which is something that she went through when her cohort was being terrible to her during her first semester. That was really a resource that I found helpful. The therapist also mentioned this Graduate Diversity Discussion Group to me, and I thought well, “I’ve heard about that.” And now you’re telling me that this is something that might be good for me and that is a space that I belong in. So, that solidified my choice, and it did help me. So, yeah.

In this group, Bianca had the opportunity to engage with different people on campus and found camaraderie among other students experiencing similar issues in their programs. Bianca’s narrative suggests that while the university is dedicated to diversity and inclusion, her STEM program is not: both she and her colleague, who identify as women of color, indicate that their experiences have been difficult or even hostile. Bianca describes her own experience as one of “turmoil,” and indicates that her friend’s experience with the people in her cohort was “terrible.”

Daniela also discusses the discrepancy between the seemingly welcoming atmosphere of the university and her experience; however, unlike Bianca, Daniela did not find the same level of support in university resources. She describes her experience attending diversity events on DMV’s campus in stating:

So, that’s how I met Monica. I went to a diversity conference not last fall but the fall before, and that’s where I met her. Actually, when I was a technician, and when I got the NSF, they were like, “Oh minority NSF woman! We want to talk to her.” And the diversity office doesn’t know what they’re doing either. For one thing, they wanted to have these meetings with underrepresented minority graduate students about what they need in order to be successful to increase retention rates because that’s a really big problem at DMV: they stop at the apply box, but whether kids are successful here or not, they don’t care. It’s a really big problem here. I learned that people drop out because they’re not supported. They had these meetings at 8:30 in the morning on a Wednesday. I mentioned multiple times that if you want people to come, and you want this to be a sustainable thing, it’s got to be a better time. My last straw was that I made, on my own time (I had a full-time job and was volunteering) a presentation to do an online portfolio workshop, and only one person showed up. They told me there was going to be 50 people there. But, again, it was at 8:30 in the morning. They said, “I don’t know why people didn’t show up.

I'm sorry." I wasn't even a student then; I was just a technician. But, after that happened, I was just convinced that this school doesn't know what the hell they're doing just like Woods Hole didn't know what they were doing. Because I was technically a minority NSF fellow and I wasn't introduced to the other minority NSF fellows until two-thirds of the way through the summer. And it was by accident that I found out about them. I thought that because I had grown up in my college career with Bridges that there would be specific minority group functions, that we would have our own counselors, and have a meet and greet. No, we were just a name for them on a paper. That was the only thing that distinguished me from other fellows. I had a talk with them about that too, very strong words with two people in the program. That it was not cool and how alienating and horrible it was and that you can't call yourself a minority NSF program when you give no support to these kids; it probably didn't really change anything. So, I was having that experience here [at DMV] except now *I* was trying to give other people support. But I didn't give up hope. I went to this diversity event with Monica, but after that, I basically stopped going to stuff. I didn't think they were very helpful. For one, I just didn't have time to go to them and also that ethnic purgatory thing came in: a lot of the diversity events, I'm finding here, means African American, and I'm not. Rarely occasionally, I see Latin American events, but I don't speak Spanish either. So, I just, again, felt like I was not going to get anything from it. The one that I went to and when I did try to interact with people even if they were from minority backgrounds, they were not from the background that I was. You might be African American or Latina, but you came up from an affluent background just like the other white people here. So, even then, I didn't really have support. So, I was just like, ugh whatever. So, no I don't think this school has really been helpful.

Although DMV sponsors campus events for graduate students, Daniela indicated that they were held at a time that was unlikely to attract a large audience, and when Daniela brought this issue to the attention of the staff, they did not make any changes. In addition to the scheduling issues, Daniela found that the students who did attend the events were not diverse in terms of socioeconomic status, which was the type of support that Daniela was specifically hoping to find.

Daniela shared another experience in which the lack of support extended both beyond her department and the campus services available to graduate students to the university administration, which affected not only her academic success but also her well-being. Daniela held a teaching assistant position for which the assignments were not clearly

stated, the expectations were not clearly conveyed or reasonable, and the support was nonexistent. This situation negatively impacted Daniela's experience in her graduate school program and her view of the university. Daniela said:

I was a TA last year for a year, and they were so abusive. I actually wrote a letter to the dean my first semester because they were so bad. So, my second semester, I needed to go to the emergency room, and no one would cover my class, so I had to teach in pain for eight hours. I told my advisor, and she said, "If you're sick, don't teach." But, there was like no plan. Like, I thought class is just going to get cancelled like I need to go to the emergency room, and then she straight up emailed me saying, "No, your classes have to be taught." My experiences with DMV University have not been great. It's unfortunate that my advisor and my lab are here, but my experience with DMV University is like they almost don't want us to be here: that's been my experience. In short, the two people who were in charge of it [the lab] were very disorganized; it was very clear they didn't care. The veteran TAs would run the whole thing. I'm pretty sure that the lab manager was fast tracked through a PhD program because I had to explain some pretty basic concepts to him. And then, the coordinator would constantly throw in topics that were not only inappropriate for the class but would also confuse students. The PowerPoints were really bad. I ended up creating all of my own lectures half way through because like my students were failing. And then the professor of the class that I graded and proctored for, she would scream and cuss at us and tell us that we were stupid, and that our students hated us, and wouldn't give us breaks, and would like keep us for nine hours. Yeah, it was really bad. And so, I wrote a letter, and I only got four of students' signatures because everybody was too scared. But, I involved the student government. I involved the dean of the graduate school, and I even involved a nonprofit that helped me write the letter. Before I was even able to publish the letter, the assistant dean of this undergraduate program was telling all of the administration that I was lying, and I was only one problem student. Because when I finally contacted the dean of the graduate school, he was the one who told me that. And he didn't feel that way. Dean Smith is a really nice guy. But he was like, "Oh I've heard about you." So, I sent the letter thinking they would give me some bullshit response, but I never heard back from them. I don't know why I took it upon myself to write this letter. I don't know. I felt like I could change something. But anyway, the next semester I didn't teach, thank God. But, there were still three graduate students who were [still] there, and they told me, on the very first day, the assistant dean who I sent this letter to, and this is a quote said, "As long as you do what you're told and don't cause any problems, you won't get fired." And then the professor who taught the class won a distinguished service award from the school. Yeah. And the next semester I thought it was ok, but my husband has an autoimmune disease, and once I had to rush him to the hospital. So, I missed one prep meeting and was two minutes late to another one. And that's when she sent

me this really long email about how my personal life is going to get in the way. Before that, she had sent an email the day of the exam saying she wanted the exams graded that night. I was like I have other things going on. Even if I didn't have a sick husband, I am a busy person. And I am dyslexic, so I need extra time to grade. So, I thought I was being a better employee by asking, "Are the other exams going to need the same turn around with the grades? Are they in the same format? Just so this doesn't happen next time, and I turn things in late." And I guess she took it the wrong way like I was being lazy, and she said, "All the other TAs got it in just fine; and you know, it's a part of your contract, blah, blah, blah. I don't know why you're so upset." And then she sent me a verbatim list of the contract and was like, "Now you know what's expected of you." So, yeah, that's why I feel like the university doesn't care about us. If I hadn't TAed, I feel like I would like have a totally different outlook. I unfortunately decided to TA because I thought I wanted to be a teacher. I might still teach at some point, but that definitely put a damper on it. So, it was my choice to do that. People in my program don't normally have to TA. But yeah, so, I just kind of feel like we're just used and abused, and they don't care. And I wouldn't have written the letter if I had known this, but that TAs and GTAs aren't legally employees, and so, we have no bargaining rights. And that was a purposeful decision made three years at a meeting to take that away from students. And so, like I could write letters until the cows come home, but they legally have no [onus] to get back to me. And yeah, then when I talked to another professor like about that one abusive lecturer, his response was "Just keep your head down and just try to be small."

Daniela's experience as a teaching assistant was not only frustrating and difficult but also discouraging to her professional development and paradigmatic of the unwelcoming campus climate that she describes. Daniela explains how she was not required to serve as a teaching assistant as part of her doctoral degree program; but, because she was interested in teaching, she requested to work as a teaching assistant. However, her negative experience has caused her to question whether she still wants to pursue a career involving teaching. The problems that she encountered with the professor of the course and the lack of support she had from the university administration suggest this negative experience was more than an isolated issue with one professor or one course. Rather, as Daniela highlights, the problems that she encountered indicate that the abuse of power and lack of support are systemic in nature and involve multiple faculty members and university

administrators. In sharing this story, Daniela explained how her experience as a teaching assistant was contrary to what she expected to find at a large, public university that espouses slogans suggesting it is a campus that welcomes students' idealism and activism as a means to promote social change.

In her narrative, Chelsea also alludes to this dichotomy between the seemingly welcoming atmosphere of the university campus and her experience in her graduate STEM program. Chelsea explains that she received information about resources available on campus during her orientation, but she admitted that she has not taken advantage of them because they were not specifically STEM related, so, she considered them to be less relevant to her needs. Chelsea said:

When I went to orientation, this guy gave me a flyer. Somehow, I'm signed up for, I don't even know what it's called, but there's some sort of multicultural office for graduate students, and they have networking events. I have not been to one. I imagine that's probably a good resource. I keep the emails coming. I just don't know how much it's going to help because it's not computer science. It's all graduate students, and I imagine there's not a lot of STEM students going to these things. I just imagine that it would be people that are more interested in networking. Yeah.

Chelsea suggests that STEM students are unlikely to even take advantage of this university resource. Are STEM students uninterested in networking? Is networking not beneficial for STEM students? Although Chelsea surmises that the networking through the multicultural office would not be specific to computer science and therefore would be irrelevant, her motivation for participating in this study suggests perhaps another reason for her non-involvement. In explaining why she felt compelled to respond to the study invitation, Chelsea said:

When I saw your email come through, I saved it because I thought the qualifications of the participants not only fit me perfectly, but that you would have a difficult time

finding such participants, particularly in computer science. I'm not sure I know any other grad student in my department that is a woman and a minority.

This information suggests that one reason for the minimal presence of computer science students at multicultural events might be due to the lack of diversity among the students in graduate computer science programs. Chelsea's conversation with her classmate about making friends in her department further confirms the difficulty in fostering inclusion among students. Chelsea explained:

The other girl in my lab is from China, and she asked me, "So, how do you make friends?" I was like, "In the computer science program?" And she said, "Yeah." And I was like, "I don't really. How do you make friends?" And she said, "I'm just friends with all the Chinese students, so I was just wondering how you meet people." So, yeah. I think it's hard in general to make connections in my department.

Chelsea's conversation with her advisor indicates that the faculty in the department both is aware of existing issues related to diversity and inclusion and has tried to address them with existing resources. In relaying the conversation that she had with her advisor, Chelsea said:

He explicitly asked me, "Do you have friends in the computer science department?" And I'm kind of like, "Not many." Yeah. And he has pointed me to the women in computing groups and stuff like that, and he's tried to encourage me to go to some of those events, so that I can network with some people that I might have more in common with. So, yeah. I think he does he want me to have a network and gets that I'm not really going to be friends with the guys in the lab or some of my other classmates.

Chelsea's narrative highlights one of the challenges for underrepresented minority women in STEM fields: although their universities may encourage diversity and inclusion, their departments, despite the well-intentioned efforts of faculty, may not. Bianca and Daniela's experiences in their programs as both women of color and first-generation graduate students echo this observation. Both women shared the feelings of isolation they had within their departments and described how they searched for broader institutional

resources to find the support they needed. Although resources for women exist on DMV University's campus, the extent to which they provide women graduate students with the support they need varies. For Bianca and Alma, their departments' women in STEM student organizations offered them new ways of seeing and addressing existing equity issues in their fields. The women in STEM student organization in which Bianca is a member has helped her to alleviate some of her feelings of "hopelessness" and "despair" by seeing the field as having awareness. For Alma, the holistic model of the Women in Electrical and Computer Engineering organization provided her with knowledge about gender issues in the field, practical solutions for addressing them, a peer network with whom to discuss these issues and possible solutions, and opportunities to engage her male counterparts and faculty members in conversation. However, Elizabeth's experience with the WIAA group was not as fulfilling: on the one hand, the events encouraged her to feel validated as a woman in STEM by introducing her to role models and helped her to establish a peer network; on the other hand, she felt left without concrete guidance for how to navigate some of the challenges she is facing as a woman in STEM.

Concluding Thoughts

The personal accounts in this chapter provided an overview of the formal and informal resources and social networks that the women identified as important to their success in their STEM programs. Formal institutional resources were integral to Bianca and Daniela when they applied to their graduate STEM programs. Through the Minority Introduction to Engineering and Science program, Bianca was able to visit one university and participate in a summer STEM program prior to applying to college. This opportunity, Bianca declared, was an unimaginable opportunity for her social mobility: it provided her

with the information that she needed to apply to the undergraduate STEM program in which she was interested, and it gave her a comprehensive orientation to a bachelor's degree in STEM. Without this program, she would have neither had the opportunity to visit a university nor would she have had access to any information about the undergraduate experience in a STEM major. Institutional resources, such as the Bridge program and the MARC program, were also important to Daniela. The Bridge program provided Daniela with the information that she needed to transition from her community college to a bachelor's degree program in her field, and the MARC program provided her with substantial support and guidance in applying to her graduate STEM program.

The connections with faculty members that the women formed were complementary to the institutional resources of support described above. For example, Daniela explained that she only heard about the institutional resources available to her from a faculty member. In fact, she stated, "Until this day, all of the programs that I have been a part of have been word of mouth." Daniela's comment underscores both the importance of the personal connections and social networks that students developed at their universities. Like Daniela, Bianca and Elizabeth also attribute their applying to graduate school to information that they received from faculty members: professors at Bianca and Elizabeth's undergraduate universities were the first people to both encourage them to think about pursuing graduate studies and tell them that it could be possible for them to attend graduate school with funding.

In graduate school, formal resources and networks were also important to Alma, Bianca, Daniela, and Elizabeth; however, the extent to which they alone could provide the support that the women students needed during their programs varied. Alma, Bianca,

Chelsea, Daniela, and Elizabeth all indicated that, at some point during their graduate program, they dealt with feelings of isolation. As they shared in their deep personal accounts, they noted that resources on campus exist to help graduate students in dealing with this isolation. Bianca and Daniela both took advantage of university diversity groups for graduate students. For Bianca, this support provided her with an opportunity to expand the small peer network that she had in her STEM program; however, Daniela did not find the institutional support to be as useful: in fact, she felt it was not really a diverse group at all, at least in terms of socioeconomic status. Given the lack of diversity, she felt it was not capable of providing the specific support for which she was looking. Although institutional resources exist, the women said that they only became informed of them through informal peer social networks and shared mixed reviews about their utility.

Alma, Bianca, and Elizabeth also spoke about STEM-specific formal resources for women in the form of graduate student women in STEM organizations. The students' perceptions of these resources also varied: for Alma and Bianca, their departments' women in STEM student organization reaffirmed the existence of the inequities that they encountered and provided them with applicable solutions; however, while Elizabeth found an important source of support, a peer network, within her department's women in STEM student organization, she felt that these women could not always provide the information or guidance that she needed.

While Alma, Bianca, and Elizabeth formed strong social connections within their departments, Daniela shared that she only really found support from other women outside of her department. Although they became connected with their peer networks through different sources, Alma, Bianca, Elizabeth, and Daniela describe the ways in which their

women graduate student peer networks contributed to their successfully navigating the identity issues that they experienced during their graduate programs. For Alma and Elizabeth, their identity issues were primarily related to being women in male dominated fields and first-generation graduate students. Bianca's identity issues were related to being a white-passing woman of color in a white, male dominated field, as well as being a first-generation graduate student. For Daniela, being a first-generation graduate student from a less affluent socioeconomic background than her peers caused her to experience identity issues. As their *testimonios* explain, the social connections they developed with other women are important to women in STEM and are even more essential to women who are underrepresented minorities and first-generation college or graduate students in STEM for whom the social isolation may be triple: in addition to solitary work environments that characterize STEM disciplines, women may feel isolated being in male dominated fields and as underrepresented minority students if their program lacks diversity. Bianca, Chelsea, and Daniela all shared the isolating experiences that they have had as women of color in their STEM programs. Although all of the women were offered institutional resources, only Bianca has found adequate support through the formal resources available within her department and on the university campus. Daniela has found support in graduate school, but it comes entirely from the informal peer network that she developed with other women graduate students. Chelsea, unfortunately, indicated that she did not find the support that she needed either through her department or through broader institutional resources. While this chapter noted multiple instances in which formal resources are available to help underrepresented minority and first-generation women graduate students both access graduate STEM programs and persist in them, students reported that they only

became aware of these programs through informal social networks and that the extent of support actually provided by these resources varied.

CHAPTER SIX: BALANCING BICULTURAL IDENTITIES AND CONTRADICTIONAL INSTITUTIONAL SUPPORT

Introduction

The previous two chapters discussed the elements of students' individual and institutional cultures that have facilitated Alma, Bianca, Chelsea, Daniela, and Elizabeth's success in their STEM fields. This chapter provides a culmination of the findings presented in Chapters IV and V by examining the duality of cultures that the women express. The five women all chronicle their experiences with dual cultures; however, they describe them in multiple ways. For example, Bianca and Daniela share very personal experiences with and feelings about the bicultural elements of their ethnic identities and provide examples of how that duality has affected their experiences in higher education. Elizabeth shares stories that show the ways in which the dichotomy between her home culture and her school culture has been difficult for her to balance but suggests that she has experienced promising points of cultural convergence. At the same time, she and Alma share examples of cultural dissonance in which they struggled to balance their distinct home cultures with the culture of the university and/or their STEM programs. Bianca and Daniela admit that their experiences at the university have altered their sense of belonging to their home cultures: at times, strengthening their ties to it but also distancing themselves from it. In addition to balancing their home cultures with the cultures of their STEM programs, the women also speak about how the cultures of their STEM programs fit within or differ from the broader university culture.

Balancing a Bicultural Identity

The women all indicated multiple aspects of culture that are a part of their identities: they referenced the unique cultures that they each share with their families, the liberal and

progressive culture of the university, and the technical and/or scientific culture of their STEM classrooms. The women shared that they felt a disconnect between their home cultures and the culture within their STEM classrooms, and they struggled to balance the two. Alma, an Arab doctoral candidate who is among the first generation of graduate students in her family, recognizes that a cultural disconnect exists between her STEM field and her home culture, which was evident to her when she attempted to explain her research to her grandmother in Arabic. Alma reminisced:

I was like I teach computers. It's like artificial intelligence. And she was like, "What does that mean?" Of course, everything in Arabic, and it's difficult for me to express things [from my research] in Arabic because I never studied them in Arabic. Then I was like, "For example, if there's a picture, and you want to know if it's a girl or a guy, my program can tell you this. It has learned to identify if it's a girl or guy." My grandma was like, "Yeah, I mean it looks like a girl. How is this something? You look. Does she look like a girl?" I was like, "How would the computer know this?" [Then, she said,] "So, you mean like all day, you're telling this is a girl, and this is a guy?" Then, I gave up. I tried to find a simple example. I think my grandma wasn't impressed.

Although this comical example of the cultural disconnect that the women noted between their home life and their STEM classrooms could also be related to the generational divide between Alma and her grandmother, it shows the difficulty that the women have in explaining their technical work and its importance to their families. Alma tried to provide "a simple example" of some of the work that she has done in her doctoral program; however, the mechanics of it were too complex for her grandmother to understand. The difference between her home language, Arabic, and the language of her STEM classroom, English, compounded the challenge Alma had in conveying the technical elements of her work to a nontechnical audience.

Elizabeth also discusses the challenge of explaining technical subject matter to nontechnical audiences. In her narrative below, Elizabeth talks about the differences in

conversations and values between her classmates and her working-class family. Despite the moral support that her family gives her, Elizabeth feels almost unable to talk to them about her research. However, at the same time, she feels uncomfortable discussing her research with her husband's family: even though her in-laws are university educated, and her father-in-law holds a graduate degree in a biomedical field, Elizabeth still feels uneasy explaining the technical elements of her work to others outside of her field. In addition to the disparate topics of conversation, Elizabeth recognizes that distinct values characterize the culture of her STEM classroom and her home culture: in her opinion, her family appreciates and admires her sociability and beauty whereas she feels the need to downplay these attributes in the university setting. In addition, Elizabeth spoke at length about the difference between her family's conservative values and the liberal values to which she ascribes. While Elizabeth is grateful for the opportunity that she has had to interact with a diverse multicultural student body at the university and attributes her cultivating this world view to her experience in higher education, Elizabeth's family suggests that she has been "brainwashed" by liberal values. In describing the differences between the culture of the university versus her home culture, Elizabeth said:

I definitely feel like I'm in a different culture at school then when I'm back home. In my family, no one has a STEM background, so, we don't talk about STEM subjects at all. We talk about day to day things, and my grandma is really into church, so she talks about that. Every now and then, they ask me about my research, but they never want to have a long conversation about it. That's good practice to be able explain what you do to all backgrounds. Usually, we don't talk about school or research or scientific inquiry, but I had a totally different experience with my husband and went to dinners at his house because his dad is a vet, so he went through [post]secondary education [sic] and had scientific training. So, I remember when I first went there I was out of undergrad working at NASA or doing internships at NASA, and they would ask me all these details about what I do and have like an open floor to talk about what I do. I was really uncomfortable because I had never had those conversations with my family before. We never talked about things in that much depth or anyone's work in that much depth. I could see the

difference between having a family who's had a background in STEM or higher education versus my family who has always done blue collar jobs and sort of thinks about world in different way. I definitely think different attributes of my personality or me are appreciated at home versus at school. For example, my aunts always compliment how I dress or how I look or just like how you interact with other people. At school, I was afraid of being too much of any of those things. I felt like I had to be more serious. The people have different interests and talk about different things and talk about things more scientifically and have a different perception of the world. My family is very conservative, so that's definitely a different culture. My friends and me from being in this environment [multicultural large university setting] have totally different views than my family on social or political issues. And then my husband's family is more aligned with my school friends. I don't know if they're [my family] aware that it's a challenge for me, but they do think I'm super liberal because I came to universities. They think universities brainwash people to be liberal. They literally say things like that to me. The few times I've had a conversation with them about it, I'm like we took engineering classes: we talked about equations; we did problem sets. I wasn't brainwashed to accept other cultures and to be more open-minded about people of different backgrounds: I was exposed to people from different backgrounds, and that was a positive for me. I think just not having that experience of going to college in this generation and being immersed in a multicultural environment and questioning stereotypes of all categories. That changed my perception of the world. For them, not having that experience, it's really hard for them to have the same outlook on life because it's just not what they've been exposed to; it's hard because I know what is right based on my experiences, but just telling them that isn't enough to change their minds about anything. They need to be exposed to it. That's such a huge, huge challenge for me, especially the last election cycle. I didn't talk to my family for a month after the election; I didn't even call them. The run up to the election was really tough. I remember helping out at church: they have an annual food sale, so I always go and help. I was there, and it was my aunt, mom, and other people; they all told me how they were [conservative], and I'm very not. And they were attacking and very strongly against my position, and I was outnumbered. I was so disappointed in them both for how they treated me and for their views and what I thought they were aligning themselves with. After the election, I just couldn't. Even though [the conservative candidate] didn't win in our state, I couldn't talk to them for a month; I was devastated. I felt they were part of this big problem from my perception. Yeah, so, it's been tough.

Although Elizabeth credits her experience at DMV University for helping to shape her worldviews, she vehemently denies that her education brainwashed her to think the way that she does. Elizabeth has conveyed a deep sense of gratitude toward her family for providing her with emotional, financial, and logistical support throughout her undergraduate and graduate degrees; however, their disparate worldviews became a

cultural clash for her after the last presidential election. This tension with her family was difficult for Elizabeth who moved to another state to live with her husband and has since relied on her family to cook meals for her and provide her with housing and transportation whenever she has traveled to campus during the past semester.

The disconnect that Elizabeth experienced with her family is not uncommon for first-generation college students whose life paths are often much different than other members of their families. Banks-Santilli (2014) describes this situation as a break in London's (1989) concept of "intergenerational continuity": Banks-Santilli (2014) explains how this break can occur between first-generation college students and their families of origin when students' life experiences and personal beliefs, often due to influences from their educational experience, become very different from their parents (p. 5). Although Elizabeth is a first-generation graduate student (not a first-generation college student), the challenges that she faces are similar: her life experiences are much different than her parents or grandparents' experiences; and as a result, they have trouble relating to each other. These differences, as Elizabeth explains below, create the bicultural existence that she constantly navigates between her family, on one hand, and her classmates, colleagues, and friends, on the other. In describing the differences between her experiences and her family's experiences, Elizabeth said:

The people you interact with or the experiences you have had are different whether you've gone to college and lived in a multicultural environment versus maybe some of the experiences of my dad's family working in an auto body shop. That's a really tough job, and you're not treated very fairly, and you don't get a lot of good benefits. You might have bad interactions with your bosses or customers. I think maybe you see the worst of people, sometimes. So, I think maybe your world view is different than somebody like my husband's family. When they were young, his dad was in vet school, and they were on campus and living in graduate student housing. It was very multicultural, and people came from different places and were really successful in their fields and had all these different backgrounds and

experience whereas maybe my family; they really know the experiences of people who grew up in coal mines. Maybe my dad and grandpa see a different view of the world and people because their experiences are through the lens of an auto body shop versus a university campus. I don't know. It's something I'm still trying to figure out myself.

Although Elizabeth disagrees with her family on most political and social issues, she tries to understand how their distinct life experiences may have shaped their disparate views. Elizabeth admits being upset with her family; however, she speaks about their conflicting opinions from a place of empathy rather than anger.

Remaining connected to her home culture has been a challenge for Elizabeth who has adopted new worldviews as a result of her college and graduate school experiences. For Daniela, forming strong social connections in graduate school similar to the ties that she had with her friends in her home culture has been a challenge. In discussing this challenge and how she tries to balance these two separate aspects of her life, Daniela said:

I definitely don't talk about research with my friends at home. They ask me about it. Like, how's it going? What do you do? They're curious about it, but no, I don't talk at length about it, and I don't want to. I'm with them to not think about school. And yeah, we [classmates] definitely talk about not school stuff, for sure. Yeah, at least in my lab. Also, I don't know if it's on purpose or not, but my advisor tends to accept older grad students and probably because she's hands off, and she knows if she accepts 22-year olds, they'll probably drown. So, I think it's my lab that's really different. I actually think I'm the youngest one in my lab. And other labs, they're all pretty young, and they work like crazy. In my lab, I think there's only like a couple people, but a lot of them are international students, and they definitely work around the clock. I remember I came once for Thanksgiving because I like left my computer there, and not in my lab but in energy engineering, which is across the hall from us most of the students were there. And I get Thanksgiving is not a holiday in China, but that's three days off; why don't you take it? You probably want to go back home and want to finish quickly, but, I don't know. There are a couple people that I talk to, yeah. I think it's better than most labs. I am a little different though than most of the people, but I think, I generally talk about stuff. I don't have anybody that I can play videogames with and stuff; all those people are back home, unfortunately, but I'm interested in other things. But, I think that's definitely unique. I've talked to other people in other labs who seem miserable. One girl I talked to she's in plant sciences. I think they're nice; they're just really

introverted. They're actually having a meeting about improving the department environment. So, I think maybe the sociology department is not bad, but scientists are known for not talking. But again, environmental science is different because our work is nothing unless we're telling people about it. So, it's a really different field. Yeah. It's really unique, which is why I'm an environmental scientist because I would not survive in a traditional academic environment. I would quit or would end up slapping my advisor or something.

Daniela describes her bicultural existence as a student in her environmental chemistry program: although she gets along with her classmates and lab group and feels comfortable talking to them about subjects other than school, she indicates that she is unable to talk with them about her family or share some of the activities and hobbies that she enjoys outside of school. Conversely, Daniela explains that she neither discusses her research with her friends from home. Instead, she separates her life at home from her life at school. Daniela suggests that she goes further than simply maintaining a balance between her academic and home lives: rather there is a complete separation. One reason that Daniela might maintain a complete separation between her home and school life may be related to the disconnect that both Alma and Elizabeth encounter between their home cultures and the culture of their STEM programs and classrooms. As Elizabeth and Alma noted, the technical aspects of STEM fields are often difficult for students to explain to nontechnical audiences of family and friends. Although Daniela indicates that her friends from home inquire about her research, she admits that she neither talks in depth about her research with her friends from home nor does she want to.

Although Daniela says that she converses with her classmates about topics other than schoolwork, she characterizes them as being "introverted" and admits that it is difficult to connect with them because of their vastly divergent backgrounds and life experiences. The challenges that Daniela describes in forming strong social connections

with her peers in her graduate STEM program contribute to her decision to keep her “home” and “university” cultures primarily divided. This division is not uncommon and has been discussed in the literature on women of color in graduate STEM fields (Cole & Espinoza, 2008; Tate & Lin, 2005). Even though her narrative highlights the ways in which she balances two completely separate cultures, Daniela suggests that her experience in her graduate STEM program is likely better than that of students in other programs: her field requires more interaction with people than other STEM disciplines where students work “around the clock,” exclude women from extracurricular activities, and meetings are necessary to improve the department environment.

Elizabeth and Daniela’s *testimonios* focus more attention on external aspects of their bicultural experiences; however, Bianca shares how, for her, this duality is much more internal and personal. Although Elizabeth describes how she sees DMV University as welcoming to and encouraging of diversity and multiculturalism, Bianca suggests that experience is not a universal one. Bianca had expectations about her STEM field: she explains how astronomy is a field that is known for being friendlier to women in comparison to other STEM fields, and she had hoped, following a similar logic, that it would also be more welcoming to underrepresented minorities than other STEM fields. In reflecting on her expectations, Bianca noted:

I think I didn’t notice this until later on, but in general, it’s friendlier field to women; and I think I was able to see a lot more female figures to look up to in the astronomy world; but I didn’t really realize it until I was able to look back later, and I thought, “Ok, the numbers really are there. The percentages are at least double digits as compared to computer science, the numbers are somewhat more representative of women.” And minorities, it follows a long – well, that’s not necessarily true; but in a field that is kinder to women, you would hope that it would be kinder to underrepresented minorities. So, I think that probably was an influence but not one that I was aware of at the time.

Unfortunately, Bianca's experience did not meet her expectations. Bianca offers details from her personal account, which suggests that there is minimal diversity and little acceptance of the diversity that does exist. In providing insight into her experience as an underrepresented minority woman in her field, Bianca said:

I noticed that at these higher levels that even the students that identify as Latino don't look like the Latino people that I grew up around. They look blue-eyed and very fair skinned. If you lined us up, we would be very fair complexioned. And it just feels kind of wrong that we're the voice, and I guess I probably didn't notice that until my friend who's black pointed it out. She and another woman for the longest time were considered the two black women in the department, but the other woman was very light skinned and had freckles and could have passed as white. So, she always had to catch herself saying, "I'm the only black woman in the department." Because that's how she felt, and it really had to do with appearance. I struggled with that because it doesn't make me less Latina that my appearance is not obvious of my ethnicity. But, as times goes on, I realize it is important how people perceive you and treat you. And your experience really can be different if you're white passing. You're acceptably a minority. There's like a certain kind of minority that seems to be a palatable person who just looks the same and talks the same as everyone else, but just happens to check that "Latina" box on their application or something. And I noticed that not only in academia, but also in media and at the higher levels of faculty. For example, we have one Latino faculty, and I was really excited about that when I first applied. I was like, "Oh wow! There's a faculty member from Latin America!" But, when I met him, I was startled that he was brown haired and blue eyed and fair skinned. If he doesn't speak, you wouldn't know that he's Latino. Even with his accent, you might think that he's Italian or something like that. There's somehow a gate to people that are darker skinned or speak differently or have different textured hair, or something like that. And it really, I think, has to do with how people are treated based on their appearance. The only people I see around the department who look like my family on my mom's side or who look like the people who I grew up around are the people who are cleaning the offices and taking out the trash and speaking Spanish to each other as they vacuum. There's a very obvious distinction. The service people who serve coffee downstairs are primarily black and dark skinned or Latino. So, it's just this reality that your met with every day that you only can belong if you look a certain way, at least that's what it appears on the surface. And so, I struggled seeing that reality, and I struggled with whether or not I should make it known to everyone that I was Latina or how to do that in a way that didn't seem fake or forced. And I came to the conclusion, after I attended a diversity focused therapy group when I was going through some tough times in my program, and the person who ran the group was also a light skinned Latina who recommended, that I should try to put up some

decorations of where my mom is from and make it known in that way. That did make me feel a little better thinking maybe the cleaning people would see that I have artifacts from their region or know that there is somebody in this program, even though it's not obvious, who was an immigrant or a child of immigrants. But then again, I look at it from the other side and think, maybe they look at it and think maybe they think I just traveled there. I struggle with that duality all the time. Talking to students, I noticed when I out myself as Latina that they treat me a little bit differently or maybe that's just my insecurity, but they kind of take a side and are more forthcoming with me about being underrepresented whereas before, they were kind of treating me as a wolf in sheep's clothing or as part of the problem and not an ally. That's probably my own insecurity coming out. But, I do tend to find when I tell my white friends, they're like, "Oh really?" kind of condescendingly. I expressed it to a colleague in my research group who said, "Oh you have Latino blood in you?" It just makes me feel like it's a detriment or something. So, it makes me avoid telling people, and I know that's problematic if I want to be representative of my people; I should be forthcoming. But, when I'm met with reactions like that, it makes me less likely to want to do that.

In revealing her deeply personal experience, Bianca struggles in processing her observation that both her STEM program and academia in general lack diversity and multiculturalism. Bianca notes how the only visible minorities that she sees in her department are the service workers, so she feels that the message being sent to students is "that you only can belong if you look a certain way." Bianca suggests that the lack of visible minorities is purposefully discriminatory and exclusionary because "at least that's what it appears on the surface.

Although unintentionally, Bianca distinguishes visible minorities from other population groups similar to the way in which Statistics Canada makes comparable distinctions. Originating with the 1995 Canadian Employment Equity Act, Statistics Canada uses the term "visible minority," which has equitable employment considerations and provisions associated with it. StatCanada (2017) defines visible minorities, according to the Canadian Employment in Equity Act, as "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour" (p. 1). The Canadian Census of

Population derives data on visible minorities from the census question on population group: the question asks a respondent to select one or more of the racial and/or ethnic identities listed, and all of the response categories listed with the exception of white are considered visible minorities. Although some of the combined responses (e.g., Black and white or South Asian and white) constitute visible minorities, a response of Latina and white does not (StatCanada, 2017).

In commenting on the lack of visible minorities in her department, Bianca says it seems that “there’s somehow a gate to people that are darker skinned or speak differently or have different textured hair, or something like that.” From Bianca’s description, this metaphorical gate seems even more difficult to break through than the metaphorical glass ceilings used to describe the obstacles that impede women’s participation and advancement in STEM. Rather, they sound similar to the “glass doors” that, according to Abu Jaber’s (2014) working paper for the Echidna Global Scholars, reify and reinforce the gendered division of labor in Jordan: these metaphorical glass doors bar women from employment opportunities and are incredibly difficult for them to shatter. In the context of Bianca’s STEM program, the function of the “glass doors” or “gate,” as Bianca calls it, is to keep visible underrepresented minority students from accessing her STEM field and perhaps higher levels of academia in general.

The perception that Bianca has about the culture of her program adds another layer of complexity to her identity crisis: in addition to struggling to express how she self-identifies, Bianca is also unsure where she fits into the very stratified system of people that she sees within her department. She shares that the students and faculty are mostly white while the service professionals, women and men of color, are the only people that she sees

who look like her mother's family. Consequently, Bianca is hesitant about whether she should make her identity as a woman of Latina background known to her professors and peers. In instances when she has shared her background with her classmates, she has been met with discriminatory responses, which are discouraging.

Although Bianca describes herself as "white passing" because of the way that other people perceive her, her use of this term is different than its historical application. Kennedy (2003) explains that the original application of the term racial passing suggested a much more intentional and strategic action on the part of the individual: "a deception that enables a person to adopt specific roles or identities from which he or she would otherwise be barred by prevailing social standards" (p. 283). Although Bianca neither disassociates herself from nor denies her Latina background, she both acknowledges and admits that she receives privileges that other more visible Latinas do not due to the way in which she is perceived by others. In reflecting on the special treatment that she receives from people because of their perception of her appearance, Bianca shares that it was a challenge for her regarding whether or how to acknowledge her Latina identity: she admits that she struggles "with that duality all the time." In providing more details about her bicultural identity and how that has affected her experience as a graduate STEM student at Mid Atlantic University, Bianca said:

There are Latino representing students who maybe think that I'm fake or that I'm not truly identifying as Latina. I'm not really accepted by either group: the white people don't see you as fully white and the Latinos don't see you as adequately Latino. So, your experience is one that's different class almost. A biracial one, and there's a spectrum there too of how much people can tell. I've had to deal with that because I can't really claim to be fully Latina because I'm not. So, I can't be the voice of Latina women because my experience is just not the same as someone who is 100 percent, so, it's my own experience. But, yeah, it's walking a fine line. So, I think that's important to say. My experience is not the same as someone else who may be faced with more discrimination just because of the way they look. Even

though internally I feel that I came from that background: and I'm trying to keep up with people, and I have imposter syndrome on the inside; my professors don't treat me that way. I find that my professors often think that I have more expertise than I feel like I have or maybe they give me more credit sometimes than I deserve. And I wonder if that would be true if I were darker skinned or had a different hair texture or color or something. I'm always very skeptical of any praise that I get. How much of this is coded by the way that I look? It makes you feel more like an imposter if you're sneaking in under the radar without people knowing where you come from or your background. There's racial imposter syndrome that plays into it for me a lot. I cringed the first time I had to tell my advisor I was going to Latin America, and he was like, "Oh why are you going there?" I can't just say I'm going on a cruise with my white relatives because I'm going to visit family that live there. That makes me worried because if everyone who is visible has been pushed out, are you going to start pushing me away or treating me differently? It's easy for people to forget. Often times, I'll be in a room, and professors who read my application and who should remember the box that I checked will say, "Well, we don't even have any underrepresented students in the room right now and that's a problem" when we're having these diversity conversations. And I feel very much offended by that. There was a list that went around, and this is what sparked my identity crisis or at least made me engage with it more, there was a list that went out in advance of the biggest conference in our field that said, "These are all the students of color that are here at the conference, and we really recommend that you go to their posters and talk to them. These are going to be amazing people in the field in the future." So, all these students were getting uplifted, and I was disregarded just because my name is not representing where I'm from or my skin color. So, just thinking if my parents had made one different choice, if my genes had been a little bit different that my experience would be so different then. I started reading things and saw articles saying white-passing people shouldn't complain about their status. They should never complain to a full woman of color about their issues because there is a magnitude difference. Then, other people said, no, it is valid. It's how you identify and the strength that you feel toward your cultural identity. There were all these discussions online that I read. So, I eventually came to the conclusion that I don't deserve that boost, but it still felt like an erasure of my identity to be shuffled in with all the white students. So, I'm feeling like I'm in this purgatory. I have this marginalized identity that no one is recognizing, and I'm not able to get any support for it, but at the same time I don't need the same support of someone who looks differently or looks more ethnically diverse than I do. And that made me really question, well, my whole life have I just been taking advantage of this? Should I not have gone to that minority- serving program? And I've always justified it to myself that I also came from a very rural community, and in that regard, I felt more underprepared because of where I come from geographically not necessarily where my family comes from geographically.

Bianca shares very deep emotions about what she calls her “identity crisis” and the way in which her classmates and professors react to her. She describes her feelings of intense isolation by suggesting that she is in “purgatory” where she neither feels fully connected to nor supported by the white students or the Latino students or students of color. Additionally, she discloses how she is both lacking recognition and support for her “marginalized identity” in her graduate degree program and throughout the university.

Although Bianca recognizes that her experience is not the same as other Latina women or women of color for whom she acknowledges might be subjected to a greater magnitude of discrimination, the challenges that she encounters and the feelings that she has are equally valid and deserving of support. Bianca shares that her experience in graduate school has left with her with more questions than answers about her own identity, which has caused her to doubt whether she deserves the support that she has received and the success she has achieved. In questioning the merit of her successes in the program, Bianca uses the term “imposter syndrome” to describe her crisis of confidence. Two psychologists, Clance and Imes (1978), developed this concept to explain how individuals do not attribute their accomplishments to their own efforts and instead see themselves as unworthy of their achievements and resulting attention. Although this concept can be applied to both men and women, it is frequently found in the literature on challenges that women, and especially women of color, encounter in STEM fields (Hyater-Adams, Fracchiolla, Finkelstein, & Hinko, 2018; Ivie, White & Chu, 2016). In revealing how the challenges of imposter syndrome intersect with her identity crisis and have affected both her experience and self-confidence, Bianca believes that her professors credit her with

being more accomplished and successful than she actually feels, and she questions whether she would receive the same accolades if she were a more visible minority woman.

Bianca acknowledges that the magnitude of the challenges that other students encounter may be greater than her own, and therefore, the support they receive should be greater; however, she says that grouping her in with all the white students is an “erasure” both of her identity and of the experience that she has had in graduate school. Bianca’s narrative conveys how the lack of recognition of the entirety of her identity has created a vicious cycle that perpetuates her identity crisis with self-doubt and keeps her trapped in the purgatory that she describes.

Bianca is not the only woman who feels that she is in ethnic and social purgatory. Daniela also uses the same terminology in describing her own identity. In explaining her ethnic background, Daniela divulged:

It’s been again more alienating than anything else because I’m actually half German and then half Spanish and Native American. Even though my upbringing was more Spanish because up until my parents’ divorce, I grew up with my dad’s mom and dad who spoke Spanish and made tortillas together and stuff. But because they were persecuted so much growing up, they didn’t teach us Spanish; they didn’t even teach their kids Spanish. They wanted us to be good little English kids. I guess my lifestyle, I guess you could say, is Caucasian. That’s not how I grew up. It’s only in high school when I met boyfriends, and I went to college that I learned that I loved video games and liked rock music. But like my formative years, my first 10 or 12 years of my life, that’s not how I grew up. But it still feels beyond my reach because my grandparents like really did not want us to be immersed in it because of how they grew up. My mom’s side is very wealthy, and I visited them, but it kind of felt superficial. Then I learned they were really abusive with my mother, so maybe that was part of it and that kept me from being close. But then they died in the beginning of high school. But, then too, even despite all that, I learned later that I’m only fourth generation German. My great grandparents moved here during WWII, moved to South Dakota, changed their name, probably didn’t speak German. They probably erased everything. You don’t want to be German after WWII. So, I don’t know anything about that too. And then because I’m mixed, and I don’t speak Spanish, and I’m light skinned, I don’t really fit in anywhere: white people don’t think I’m white, and most people of color, especially women, get upset

when I refer to myself as a person of color. So, I don't really feel like I fit in anywhere. And then because of my grandparents wanting to shelter us from their culture because they felt like it was the right thing to do, not only do I don't fit in anywhere, but I don't know anything about either culture. I feel like I'm in purgatory ethnically and racially most of the time. Yeah. On one hand though, it's kind of cool because I understand both sides.

Daniela shares that she, like Bianca, feels isolated due to the way that she self-identifies ethnically. Daniela also indicates that she feels excluded from the support available to underrepresented minorities on DMV University's campus, which is not targeted to her background or needs. In addition to referring to her multicultural identity as a space of ethnic and racial purgatory, Daniela suggests that the isolation that she experiences is more due to her socioeconomic status in her childhood, which is another characteristic that sets her apart from the other underrepresented minority students, who seem to come from more affluent backgrounds. For Daniela, poverty was the most salient aspect of her background and served as a unifying factor for her childhood friends and classmates. In graduate school, this part of her identity has created a disconnect between her and other students in graduate school, which has contributed to her feelings of isolation. In reflecting on the internal conflict that she experiences regarding her own self-identification, Daniela noted:

I didn't feel that way [conflicted about self-identification] growing up because I lived in the ghetto. We were all just poor. I don't want to say there weren't race crimes, but we were just all poor kids in the ghetto. We were all dealing with the same things. It wasn't until I got into college that we even discussed race. Because we were so poor. Talking about race was just totally out of our frame of thinking. My mom was mentally ill, and my dad was a drug addict. I had a friend whose dad burned down the house, and it was totally normal. It wasn't until I got to college, and I was around more white people. It was a different type of whiteness. Because we were all so poor. We were living with so many different races and backgrounds. The classic whiteness I had never really experienced it. I had a couple of white friends. They were rich friends, and we were kids, so I didn't really see it that way. It wasn't until I got older really here is where I started noticing it a lot more. That I didn't feel like I was white. Even in college, when I got into the minority programs

and I had to fill out the race things, it was either white, Latino, Asian, African American, or other, and you had to pick one. And it made me so upset because I didn't identify with either of them. I didn't want to say that I'm Chicana or Latina because we were so far removed from that. But I was steeped in that during my formative years. My Christmases were tamales and tortillas and flan; it was not turkey and ham. I remember we went to my mom's family, and I'm like this food is so horrible. We were putting ketchup on our ham. I always felt more comfortable with my dad's side. My mom's side was very middle class. And totally turned our backs on us. That also caused me to not feel like completely Latina in my ethnicity and my cultural association, but I don't identify with this whiteness that people are talking about because my mom's family is rich whiteness; they didn't help us and weren't accepting, and I didn't like their food. I guess, stereotypically, I like white things: I don't like rap or mariachi music or R&B. I'm nerdy. On the outside I can see why people are like, "You're just a white girl." So, I guess I am more Caucasian than anything else. I was like why do I feel this weirdness if I have to put that?

Daniela, Bianca, and Elizabeth all reveal that balancing their bicultural identities has been a challenge for them. Daniela and Bianca's experiences and interactions in graduate school have compounded this challenge, often making them feel more marginalized. Elizabeth reports that she has assimilated into another culture in graduate school and struggles to maintain ties to her home culture and familial values while adopting this new culture and value system. Daniela feels that there is a social disconnect between her and other underrepresented minority students at DMV University due to their difference in socioeconomic status, which has made it difficult for her to relate to other students in her program and on campus. Bianca confides to having experienced a similar problem in connecting with students: she is neither fully accepted by white students nor underrepresented minority students, and she describes this situation as being in purgatory. For Elizabeth, the disconnect with which she is faced is related to embracing new values and viewpoints that are contradictory to her family's principles and perspectives. Creating a balance between "home" culture and "university" is a challenge that has been discussed in the literature on underrepresented minority and first-generation college students. (Cole

& Espinoza, 2008). Elizabeth, Bianca, and Daniela's accounts each provide personal insights and context about the manifestations of that challenge.

Contradictory Support

Chapter five highlighted the institutional resources available at DMV University and examined the extent to which students perceived them as supportive of multiculturalism, diversity, and gender equality, and the *testimonios* shared in this chapter show how underrepresented minority and first-generation women graduate students describe themselves as balancing bicultural identities within their graduate STEM programs. Delving further into the students' accounts provides evidence that their experiences within the institution also conflicted because of contradictory support available to them: on one hand, the university uses rhetoric that suggests support of diversity and inclusion; on the other hand, students' stories of socialization on campus reveal that their experiences in their graduate STEM programs remain a struggle for them.

Daniela has attended some of the diversity events on DMV's campus; however, she did not find the support for which she was searching. As a result, her perception is that the university neither welcomes nor supports all of the aspects of diversity that exist among its students. In explaining how she formulated her opinion from her experience, Daniela shared that she attended a university diversity event with her friend Monica but found that the events offered did not meet her personal needs: the students who attended the event were of underrepresented racial or ethnic backgrounds, but they were from affluent backgrounds. Daniela, who self-identifies as Latina, Native American, and white of German ancestry, describes herself as being "in social and ethnic purgatory," which is evident in the way in which she struggles to define her own identity using terms that vary

from Latina to Spanish to Chicana throughout her *testimonio*. The struggle that she experiences in self-identifying reflects the difficulty that she has had in finding institutional support: the events targeted to Latin Americans were not helpful because she does not speak Spanish, and the events targeted to other underrepresented minority groups (e.g., African American students) were not relevant to her particular needs.

In addition, she said that she attended some of the events after which she left feeling more disconnected from the other students who appeared to come from more affluent socioeconomic backgrounds than her own. Perhaps that's why, Daniela felt that she could not receive the support that she needed from the university: although she shares that the university offers resources to graduate students, her perception, from participating in them, is that while the university may endorse multiculturalism, support is lacking for the socioeconomic diversity of the student population.

Alma's indicates that while diversity does exist on DMV's campus, students were not as accepting or supportive of it as she had anticipated: she grew up learning that America is "this melting pot," but she discovered through her interactions with students on DMV's campus that it is not. In relaying her experiences as an Arab woman interacting with her classmates in her STEM program, Alma said:

My first office mate, I think, didn't know where my home country was. When he asked me where I was from, I said the Middle East. And then eventually he heard me speak Arabic to my parents, and he said, "What's this language?" And I said, "Arabic." And then he said, "But you're not Arab, are you?" And I'm like, "What do you mean?" And then he answered, "Oh, so you're Arab, but you're not Muslim, are you?" And it was the exact order like this. And this was a big shock to me because oh, you see America, and you think you're coming here and everybody is so accepting, and they teach you this at school: that it's this melting pot. But, it's not really. People really care where you're from; no matter where you go, they really care where you're from And I get told, "Oh, you don't look Arab." So, yeah. It's [my ethnicity] been important.

The microaggression that Alma shares is one way that students experience discrimination, which can affect both their persistence in graduate school and their academic performance. Merriam-Webster dictionary (n.d.) defines a microaggression as “a comment or action that subtly and often unconsciously or unintentionally expresses a prejudiced attitude toward a member of a minority group.” These microaggressions are particularly detrimental to underrepresented minority women in STEM who may experience these unpleasant interactions related to both their gender and their race or ethnicity. In her narrative, Alma says that people tell her “you don’t look Arab.” Although nothing discriminatory is actually said about the way Alma looks, the implication of that statement is that it is a good thing that she does not look how the speaker perceives an Arab woman to look. This comment sends a message that all Arab women look the same and that image is a negative one. In the conversation with her office mate, the implications are similar: it would be better if she were not Arab and if she were not Muslim.

Like Alma, Chelsea, who is biracial, also shares how her race and gender both have been shaped her experience in her graduate computer science program. Because there are so few women and no other women of color in her program, Chelsea indicates that she feels “own her own” and “without much support.” Chelsea expressed how the pressure and isolation that she feels escalates when her classmates look to her to be the spokesperson for all women:

I think it’s a combination of my gender and skin color because I don’t know anybody else that is a black woman in my program or even a Hispanic woman. Anybody that is American and has my skin color. There’s nobody else like that in my program. I feel like I am on my own without much support, which makes me feel anxious. Not only because I am a woman and how I look but because I am a beginner in the field. So, yeah. It makes me feel like I stick out. And I think I talked about that it makes me feel like people are looking for me to mess up or something like that or just looking to see how I behave in general, maybe. It’s almost obvious

that when people interact with me that they haven't interacted with a woman who looks like me in their field as a coworker. So, they look at me like I'm a representative of that. I did have an experience last semester. We go to lunch every Friday. It's a lot of people: maybe 10 of us, me and the one other girl usually comes, or it's just me. Two guys were talking, and one of them said how they don't think that these women in computing associations help because then women are just isolating themselves more or something. And the other one was kind of like, "I don't think that's the point. It's just so they have a network and know other people are in this field." Then they both simultaneously turned to me and asked me my opinion. It was funny because I was not in the conversation in the first place, but because of the topic, I became the expert opinion. So, there are situations like that, which are interesting.

By asking Chelsea to be *the* representative of her gender, her classmates unknowingly burden her. Although she is a woman of color in the graduate computer science program, she is neither able nor willing to speak on behalf of all women graduate students in her field: her experience and opinion are her own. Furthermore, by asking her to mediate the debate about the role of women in STEM student organizations, her classmates assume that she is the arbitrator for determining whether the culture of the graduate program is sexist or not. This situation highlights the dichotomy of the department culture: although the department offers a women in STEM student organization, Chelsea's experience as the only woman of color in her program suggests that there is little understanding of the intersectionalities of women's identities (e.g., gender, race, ethnicity, socioeconomic status, etc.) and the challenges that they face in male dominated fields. The lack of support from male counterparts is also discouraging and provides another example of how women are subjected to microaggressions that discourage their participation in STEM programs.

Like Chelsea and Alma, Elizabeth said that being one of the only women in her program has affected her perception of her own success and participation in graduate

school. She reveals that she feels intense pressure about her performance in graduate school being somehow representative or reflective of all women in engineering. Elizabeth did not identify “as being a woman in engineering” until she entered the workforce after graduating with her bachelor’s degree and witnessed gender inequities in the workplace. The inequities that Elizabeth saw combined with the lack of visible role models has caused her to doubt the way that she feels as woman in engineering. Elizabeth explained:

When I was an undergraduate, I never really identified as being a woman in engineering, and then things started to change when I worked full time: I saw women leaving the workforce. I saw couples who were both working at NASA who were both engineers, and the woman was the one leaving early to take care of her kids or leaving all together because she wanted stay home. So, I was like that’s not fair; that’s not equal. So, I carried that into graduate school, that knowledge. I think the main feeling I had when I realized that I was the only girl in my classes is that I felt that I represented all of women in anything I did. If I succeeded or failed or if I asked a dumb question, people, because I was the only one in the class, would assume that all women couldn’t figure this out or that it would reinforce negative stereotypes if I weren’t to succeed. That’s the main thing I think of. And I think maybe being less sure that I could succeed in everything maybe made me identify more: I felt like I needed more to see women succeeding in my field than I had ever thought about as an undergrad. I think it’s not ever having personally known anyone that went through graduate school. Yeah. There’s no one in my family that identifies as being a scientist or that highly educated or anything. And then, but even at Goddard, I really respected two people who had PhDs but neither of them were female. Maybe if one of them had been, that might have made a difference.

The lack of visible role models in her field, being one of a few women graduate students in her classes, and not personally knowing anyone who has gone to graduate school has affected Elizabeth’s experience in her graduate engineering program. In addition to the difficult coursework, Elizabeth also struggles with the pressure that comes from being one of a few women in her field: she feels that her classmates view her as a representative of all women in engineering, and she is discouraged by existing gender inequities that she witnessed in the workplace.

Alma shares that she has also witnessed and experienced sexism and microaggressions related to gender, which she was not expecting to see in the United States. For example, Alma noticed that women professors are often introduced with their names only whereas men professors are introduced by their titles. Alma recalled how the interactions that she saw within her department did not reflect the idealized image that international students often have of gender equality in America:

I mean sexism in general it's present. A lot of students, especially international students, come not aware that there's not going to be another woman or there's so few women. They're also not aware that in the U.S. that these things [sexism or microaggressions] happen. Sometimes, you think that you're coming to the U.S., and you think that these things don't happen here. So, that's why I think it's important to know that these things can happen and might happen if you don't take the steps to protect yourself. Yeah. Within STEM programs, you can, within a sexist environment, be told to shut up. There were a lot of instances where female professors were introduced with just their first and last names whereas males were introduced as professor or doctor, so just being aware that this kind of stuff happens.

The gender dynamics within the culture of the university did not meet the expectations that Alma had for the United States and were much more inequitable than the gender dynamics to which she accustomed from her family in the Middle East. In contrasting her experience in her graduate STEM program with her feminist intrahousehold gender dynamics, Alma said:

My mom was my dad's boss, so growing up we were never told you're a girl you can't do this. Nobody would dare to say this to us. They knew there was this relationship that my parents had. So, even my dad would joke about it: "she's the boss." Even at home, he would say, "Ask your mom, she's the boss." I think whenever I felt like I was being dismissed for being a woman I would think, at least not consciously, like my mom is my role model in this. If my mom's able to do this, and if my mom is able to do this in the Middle East, I should be able to do this in the U.S.

Contrary to her expectations, Alma attributes some of the challenges that she has encountered during her graduate STEM program to existing gender biases and inequities.

In reflecting on some of the problems that she had in her relationship with her advisor, she now suspects that he may have harbored some gender biases; however, she acknowledges that this accusation is a difficult one to prove and admits that she cannot say with certainty that the degradation of their mentorship was related to her gender. In detailing the difficult relationship that she had with her advisor, Alma alleged:

The fact that I'm a woman has also affected my experience. I suspect that part of the reason why the relationship with my previous advisor was so bad is because I'm a woman. I'm not sure. I may be speculating. But after the fact, I went to his website to look at his record of all his publications, and I saw that whenever he was an author of a paper with his students, if the student was female, she was second author. And that's what he did with me even though it was my work. And whenever it was a male student, he was first author. And when I brought this up to one professor that I'm very close with, he said "Oh, you know, it's very skill based, you can't really tell. Maybe they did less work." But, I didn't do less work; it was my work, and he put me as second author. I don't really know. Again, I'm biased, and so, I'm possibly reading into this more than actually was. But I suspect that part of why this thing didn't work out is because I am a woman. There were a lot of times that he dismissed things that I said. He used words like "Stupid. This not worthy of a PhD. What are you doing here?" I left his office crying for like two and a half years in a row every time I met with him. And then looking back at his record, one time I questioned him: "Why am I being put second author on this work? This is my work." And he said that I didn't do enough to deserve to be first author because he started writing the paper, but he didn't tell me, let's publish these results. He wrote an introduction and said, "Fill in the results section." And then he said that because I didn't write the introduction section, I couldn't be first author. It's not like he asked me to do it, and I didn't. We hadn't discussed this. So, yeah. And when I looked back at his publication record, I looked at every single publication of him where he's not the author, and I saw that it was like that whenever it was a female student that she was being put as second author. I'm not comfortable saying for sure that's the reason. It just seems likely that it is. Especially that he has not graduated any female students except one who's from his home country and who graduated with two publications where she is second author.

In her *testimonio*, Alma described some of the unpleasant interactions that she had with her advisor that left her feeling discouraged about her work in graduate school and her potential in the field. The situation that was the most upsetting to Alma was when her

advisor listed her as a second author in a publication of her own work. Alma reviewed a list of her advisor's publications with students and noticed that his female students were always listed as second author whereas his male students were listed as first author. Although she concedes that she might be "speculating" and that it's possible that the female students did less work than the male students, which would warrant them being listed as second authors, Alma knows that she did not do less work and was still listed as a second author. With her own experience in mind, Alma suggests that her advisor might have a gender bias.

Alma notes that gender bias is also present among the students in her program. She shares how students will sometimes attribute her achievements to affirmative action policies designed to foster gender inclusivity and equality, which downplays her own abilities and success. In reflecting on her interactions with students in her program, Alma noted:

Another thing is that people think that I got accepted, or I got a fellowship, or I got the internship because I am a woman. And a lot of people try to downgrade my successes to say, "Oh, of course you were going to get it: you're a woman; they'll take you." And it's not necessarily true. Maybe there are some affirmative action things, but I don't think that's the case, especially with companies, they're just trying to hire whoever is best for them. So, yeah these are the aspects that I felt affected me as a woman from the Middle East.

These interactions fuel Alma's crisis of confidence, which she refers to using the terminology that she learned in her department's women in STEM student organization: "imposter syndrome." Alma reports that other women in her program also have experienced similar feelings. Sometimes, Alma is plagued with self-doubt about her ability to succeed in her program as a result of incidents with some of her professors and peers. During our conversation, Alma announced that she had her manuscript accepted to a highly competitive conference, which, both she and a program director in her department noted,

is a more noteworthy accomplishment than a publication in a refereed journal due to the fast-paced nature of her field. Despite her achievements, Alma still frequently questions the merit of her success. In a conversation with her classmate, Alma realized that other women in her program also felt the same. In summarizing these mutual feelings, Alma said:

I've had a lot of imposter syndrome moments. Just yesterday I had a paper accepted to one of the top conferences, so I'm really happy about it. But the day before, I was crying to my boyfriend saying, "I don't think I've done enough saying I'm going to look at this degree my entire life and think I don't deserve it" So, I have my days. Sometimes I feel unsuccessful, and sometimes I don't. A girl in my group came to my office a week ago, and she said, "Can I talk to you?" She was having a really hard time. She's not from an underrepresented group, but she told me something that really resonated. She said, "When my papers get rejected or I can't do any progress on my research, maybe that's why there's no women in the group: maybe they're not good." I think that if you talk about this and realize that you're not the only one feeling this way that it helps to get over it somehow. I never thought that's why there's not women. But I think that's also something that affects other women. The fact that there's not women in the department comes back to haunt them when they're having a hard time. They think of it as, "Oh, maybe that's why there's not women." After I had this chat with this friend, I realized that we should talk about these things. But I hadn't realized that it was so common.

While Alma has experienced unexpected gender bias from faculty and students, which has caused her to question her abilities and achievements, she has also received recognition and rewards from her department that have been both supportive and validating of her success. In providing an overview of these awards, Alma said:

So, I was given two awards one from the department and one from the school, but both of them were for teaching and not for research. I was also a part of the future faculty program, which is something you apply to and not everybody gets accepted, so it's a competitive program. So, one of two awards a professor nominated me for. Actually, both of them. One of them specifically touched me because it was during the time I had no funding. It came with a \$5,000 award, and it was supposed to be an application that the student submits. That professor asked me for my CV and wrote me a recommendation; he didn't tell me. I received this award, and I was very confused. So, I told him, and I said, "I don't know how I got it because I didn't

apply for it.” He said that he had nominated me but didn’t tell me because he didn’t want me to be disappointed if I didn’t get it because I was already going through a lot. So, I was really moved by this. And that was validating. So, in my department, grad students have to take a proposal exam, so that’s at least one year before you defend your dissertation. It’s a presentation about what you’ve done so far and what you intend to do. When I took that exam, one of the committee members said that was the easiest yes that he had ever given. So, I try to remind myself of that when I doubt myself.

Alma’s account provides a glimpse into the contradictory experiences of women in graduate STEM programs at DMV: Alma reveals that gender biases and inequalities exist within her department and have exacerbated her (and other women’s) feelings of self-doubt; however, she also has received support and validation from faculty that have helped her to persevere through discriminatory experiences in her program and reaffirm her success.

Alma is not the only student who has dealt with gender biases and imposter syndrome during her STEM program: Chelsea recounted a situation in which her advisor questioned her ability to persist in the program, a conversation that could be perceived as discriminatory. Chelsea admitted that during the first year of her program she had a difficult time with the coursework and a research project that was assigned to her. Despite these challenges, Chelsea continued to persist in her classes and research. In a discussion with her advisor, he incorrectly assumed that she was contemplating dropping out of the program simply because another student “who was just like her” did the same. Like Alma, Chelsea cannot definitively say what motivated her advisor’s assumptions; however, in her narrative below, she alludes to the fact that they might be gender motivated. Chelsea recalled:

And he [my advisor] made a comment, so my grades weren’t that good the first semester, and he kept asking me, “What are you going to get the second semester?” And I was like I don’t know my grades until the end, but I think I’m doing well.

And he just gave me a look like ok if you think. So, once I got my grades, I went into his office, and I said, “hey, I got As, you know, just in case you were wondering.” And he said, “Oh, no, I wasn’t worried about your grades. I was just worried about your well-being because I had a student who, you know, was similar to you,” and I don’t know what that means, “who ended up, you know, dropping out.” And I was kind of shocked because I gave him no indication that I was dropping out. I don’t know why he associated me with that anyway because the situation is different: She [the woman who dropped out] is a white woman. So, she went there [into the computer science program] with the intention of getting her PhD and then ended up just getting her master’s. She didn’t drop out, but I think she just decided that getting her master’s was going to be fine for her goals. She’s since gone on to get a job and make a ton of money. So, I think that she’s doing fine. So, I don’t think it was because she was suffering so much in her classes that she had to drop out. I was never planning on getting a PhD; I never had talked to him about dropping out. So, I think he just saw that I wasn’t as involved in the lab as some of the other members, and instead of talking to me about it, he assumed I was a lost cause. So, yeah. He is in charge of a lot of people, and it feels like he did not want to put the effort into seeing what was going on with me. He just figured that I can either help myself or I won’t. If I don’t, then maybe I’ll be dropping out. I don’t know. So, I guess that’s what that was about. Since then, I’ve been much more involved in the lab, so I haven’t gotten any such comments from him or any such concern about grades or anything like that. That day when he said that comment, I was taken aback, but I had enough strength to be like: “I’m not dropping out. I’m not going anywhere.” And I said that to his face, and since then, he has not questioned my ability to get through the program. So, it’s improved. But yeah, that was not a good experience at all. Yeah, it was really awful. The only person that is there to mentor me. I don’t have another person to go to. So, that was pretty upsetting just being a graduate student; that’s your advisor. And it’s not like I was thinking of switching advisors because there’s really nobody who would fit my interest that I would switch to anyway.

Although Chelsea cannot explain why her advisor made this unfounded assumption about her as a recognizable underrepresented minority (woman of color) in her field, it is clear that he made a quick comparison to another student whom he saw as “similar” to Chelsea rather than investigating why she was having difficulty in the program or offering her any support. The types of biases that Chelsea and Alma both experienced are detrimental to women’s confidence and can affect their performance in their fields, especially in graduate school where a student’s advisor is responsible for education and mentorship. Chelsea was confused and discouraged by her advisor’s remarks about her,

which amplified her feelings of self-doubt about her knowledge and ability; however, Chelsea is hopeful that her relationship with her advisor is improving. In fact, she said that her advisor now acknowledges her project as one that is he proud of in the lab. In discussing this complicated relationship with her advisor, Chelsea shared:

I meet with him maybe every other week now, and he is proud of my progress. There are some weeks where he's like why haven't you done enough? Even the other week I met with him and told him what I had done and gotten a good compression ratio, and he was happy enough to make me to give a last-minute presentation that afternoon. He's had me share what I'm doing with other people who have visited the lab. So, yeah. He actually acknowledges [my] project as one he's proud of in the lab. I had a really weird experience the other week. I had a meeting [with my advisor], and normally, he's trying to rush me out: business and then let's go. I was in his office telling him my progress and asking him what I should do next. And, it felt like he was getting antsy and wanted me to go. And he was like, "Wait a second, sit down. So, how are your parents?" I was like, "What?" Like he had never asked anything personal before, and he doesn't know anything about my parents. So, I thought that was kind of funny. It's different at least. I was like, "They're good." And then he started asking me about what I'm looking for in a job. So, I think he was trying to get to know what my goals are maybe because I'm getting closer [to graduating].

Her advisor's unfounded biases and presumptions have made Chelsea question her knowledge of computer science and ability to be successful in this program and field; however, his recent validation of her work has helped her to persevere despite the prior negative and perhaps discriminatory experiences.

Unlike Alma and Chelsea, who have encountered both encouraging and discouraging aspects related to diversity and inclusion in their graduate STEM programs, Bianca reports overwhelmingly negative experiences. For example, Bianca has also been affected by prejudice and imposter syndrome during her STEM graduate program. In her case, Bianca perceives that her classmates harbor biases about diversity and affirmative action policies. Bianca shares that throughout her education, her peers have suggested that her success is not because of her own merit or ability but rather due to affirmative action

policies, which may have given her a “boost” as an underrepresented minority student. Bianca’s internalization of these biases has created self-doubt about her own knowledge and capability. In conveying the ways in which these accusations have impacted her, Bianca said:

It’s always hard for me to shake that - if they’re asking me about that - saying this box is marked because of underrepresentation, and I was getting shuffled toward the top of a pile instead of my peers. People would always say that to me early on in high school that I was somehow given boosts because of being Hispanic. I’m still dealing with it. I haven’t dealt with it fully. Just this feeling if anyone would see inside my brain that I would not be here. I’m able to portray what a graduate student should be like but I’m missing fundamentals to study problems. I had a faculty member sit me down, and he was the person who taught the introductory course and said, “You need to speak out more. If you don’t ever talk, people aren’t going to know what you know.” So, you should be always trying to ask questions. To me, that such an uncomfortable position to be in. That was sort of my protective measure was just to keep quiet in discussion and never let my insecurities show or people know what my weaknesses are. I still don’t get a sense of what is ok to not know or what I’m expected to know. It’s not uncommon for me to go into a meeting and not say anything for the entire meeting. It stems from a feeling that I’m going to do more harm than good if I open my mouth. To have that called out from a professor, was to have that called out a little bit. If I write a paper, no one is going to want to read it. And just constantly feeling like colleagues are pandering to me, and it’s not because I’m doing well, but that’s what they have to do to be a good mentor. I’m aware of all these things are symptoms of imposter syndrome. One thing I’ve said to my friend is that, “I don’t have imposter syndrome. I actually am an imposter. I’m the case where that’s true.” She shrugs that off and says, “You’re so accomplished.” I try not to say that because if she thinks I’m accomplished, how does she feel? We try not to be negative to each other. People are not as supportive.

Although all of the women discuss their challenges with imposter syndrome, Bianca shares the extent to which she has internalized these self-doubts and says, “I actually am actually an imposter. I’m the case where that’s true.” Bianca’s account highlights the double burden of prejudice and discrimination that she faces as a woman in a male dominated field and an underrepresented minority student in a predominately white institution.

In addition to the prejudice that she faces from her white peers who have insinuated that her achievements are due to her Hispanic origin rather than her own efforts and ability, Bianca has witnessed discrimination of Latino students by other Latino students. Bianca shared:

My friend is running a diversity program here, and it's bringing in students from underrepresented minority backgrounds into the program to do some research. She expressed that she was frustrated because she said [regarding one of the participating students], "When is your Latino side going to come out?" It's an erasure of identity if you don't act a certain way or speak a certain way; you don't belong in spaces where other Latinos are. On one side, I understand the frustration of women of color with the privilege of being white passing, but on the other hand, it's hard to feel fully privileged. There's always a yearning for me to have my identity acknowledged.

Bianca's *testimonio* illustrates double discrimination that women of color can experience: they can be marginalized by white peers for being underrepresented minority women and by Latino peers for being white-passing.

Elizabeth acknowledges the compound challenges that women of color face in STEM fields, which she has become more aware of due to her experiences as a first-generation woman graduate student in a male-dominated field. She shares sentiments similar to Alma and Chelsea about being a woman in a STEM field and recognizes that the magnitude of those feelings is probably worse for women who are not only marginalized because of their gender but also because of their race or ethnicity. Elizabeth contemplated:

I think I learned about imposter syndrome in graduate school, which I hadn't heard about before, that I think affects a lot of people in STEM and maybe affects more women than men. It's something that I at least became aware of in graduate school, and I suffered from it. My advisor has alluded that even he suffered from it. Maybe it affects minorities more because you don't see other people like you in the same situation, so you think I definitely got here by accident. I think another thing I have noticed is that sometimes I have a voice in the back of my head being like you won't be able to understand this, so sometimes when I'm reading papers I'll just skim over the details because I think, "Oh, you won't be able to understand this."

And I know if I sat down and tried [I could]; I think the comprehensive exam was good for teaching me that if you put in enough effort in, you can learn any topic, but I feel like that voice was minimized at the time of my comprehensive exam but maybe has crept back up.

Elizabeth added:

It's not something that I usually think about except I feel worse for people who are double minorities in my situation. I was just at a conference earlier this week. It was an international electric compulsion conference, so it's all people in our field. I have one other girl, a graduate student friend, who was there, and she said she had been counting the percentage of women in the room she was in, and said it was always less than 10 percent. So, we think it was less than 10 percent overall at the whole conference. And I happened to notice, I mean this was an international conference, so there should be a broader representative of other ethnic backgrounds, but it is still very heavily while male. I think a lot of the keynote speakers were also white males at this conference. I noticed one minority female there. She was not the only African American at the conference, but this is hundreds of people, and she was one of a few and also one of the few women. So, I noticed that, and I could identify with her as being one of the only women there. And I could imagine it is worse being a double minority in that situation. So, I guess that's just been on my mind. I've just been more conscious of it. It's just that being a minority female has made me more conscious of how other minorities could feel in broader situations. Just to be the only one of your type, however you identify at that time, in a room is an experience that everyone should have to have. Everyone who is from a majority group if they could have that situation reversed for them; they might be more empathetic.

Elizabeth indicates that she has dealt with imposter syndrome throughout her graduate degree, and she acknowledges that the challenges that women of color face in her program may be greater than her own. Although the lack of visible role models and instances of gender inequity have fueled some of the self-doubt with which she is plagued, Elizabeth shares that her work and success also have been endorsed during her graduate degree program: she has held leadership roles and has received financial awards. Elizabeth is both appreciative of and humble about these accolades; however, she recalls one experience in which she felt she "didn't get what [she] deserve[d]" when her advisor

nominated another male student in her department instead of her for an award that she was more qualified to receive. In expressing her feelings about this situation, Elizabeth said:

There was one thing. The only time that I've maybe felt like I didn't get what I deserve. But, also, I feel like I've gotten more than I required. I think they [the department] have been really generous overall, and I'm really lucky to get a lot of recognition. There's this award every year, a service award, a couple thousand dollars, for leadership in department. Last year, it came out, and I thought I should at least be able to apply for it because I was the president of graduate student committee, which is the biggest leadership role a graduate student can have in our department. I tried to start all these initiatives and tried make events happen and start new programs in our department, and at the same time, I was the vice president of the [women in STEM] group too. That's unheard of, being a graduate student and holding two different leadership positions. We started a lot of initiatives and a ton of events. I organized happy hours at the aviation museum for faculty and students and did all kinds of things: I talked to prospective students, gave tours, answered questions over emails; I did way more service and leadership than anyone else in department, but I didn't want to nominate myself for the award. So, when it came out, you could be nominated by someone else in the department or you could nominate yourself. I was waiting for someone else to nominate me. So, I hadn't heard anything, so I just asked my advisor because I knew I could use the funding to travel to conferences. So, I asked, "Can apply to this? Will you write me a letter? I think I have a good chance of winning, and I could use the funds to travel to a conference." And he told me that another lab mate asked to apply first who hadn't done the same amount of service as me, but asked to apply for it first, so that he thinks that he would have a chance to win it if I didn't apply. So, I was like "Ok." There was nothing that I could say. I was pretty upset. I thought that was unfair. But I wasn't going to be like: no, I have to apply, and you have to invite me a letter. Then, I found out later that he let yet another lab mate apply for the award but didn't have me apply because he said, "You've gotten a lot of awards already." I knew that my other lab mates weren't going to be able to compete with people from other labs. I was the one who was involved at the department level. There were other people involved at same level as me in other labs, and I knew they [students in her lab]s weren't going to win over those other people, and they didn't. So, I felt like it was all sort of for nothing. So, that was pretty upsetting. I wanted to talk to my advisor, but it's hard to criticize him for that. So, I haven't. That's the only time I feel like I wasn't recognized. Then, he ended up, I think he felt bad about it, so he ended up nominating me for university level grad student service award, but really, I wasn't qualified for that because I hadn't done service at university level. So, the people who win that award, you can look at their resumes: they're on graduate senate, and they're president of senate, so they deserve that award. But, I deserved the one for our department level service. Not that they [the male lab mates] hadn't

done things that were valuable. But, yeah. Not even close. But, it was more that I had an NSF fellowship, and he didn't have enough money to pay them what they should be paid. So, he [my advisor] saw it as a way to make up for their funding deficit.

The waxing and waning of support throughout her graduate program has complicated Elizabeth's self-doubt and feelings of imposter syndrome. While Elizabeth acknowledges that her advisor was trying to help other students to secure necessary funding through his nomination, she is disappointed that she had to diminish her own achievements in order for a less qualified male student to be uplifted.

Focus Group Findings

During the focus group session, we revisited some of the common themes that emerged from the individual interviews. Imposter syndrome, which four out of five of the students mentioned by name (the fifth described it without using the term) in their *testimonios*, was one topic that the participants discussed at length during the focus group. Four of the participants, Bianca, Chelsea, Daniela, and Elizabeth, attended the focus group, which lasted a little over two hours. At this focus group session, all of the participants met for the first time, and during the two-hour conversation, they shared their experiences as women in their STEM programs with each other. The four women immediately related to each other because of the similar challenges that they had encountered, one of which was imposter syndrome. Various layers of imposter syndrome unfolded throughout the dialogue: being new to their STEM fields and unfamiliar with the STEM culture and jargon, being women in male dominated fields, and being an underrepresented minority in their fields of study.

Bianca, Chelsea, and Daniela reported that they have felt like imposters in their graduate STEM programs when they have had to give presentations to or share their

progress with their classmates/lab mates in a formal classroom setting. Bianca provided an account of her imposter syndrome:

I feel like I've had to, as an imposter, infiltrate this culture on top of trying to learn in science, and learn the specifics of my research and try to infiltrate this culture that exists, the way that people even interact with each other, on top of having the language to ask my professor what I want to ask him without sounding completely ignorant.

Chelsea and Daniela quickly related to Bianca's comments: Chelsea shared that she had similar feelings as a new student in the computer science field when she had to give progress updates during her lab meetings, and Daniela noted that her symptoms of anxiety worsened when a professor suggested that she "talk more science-y" and insinuated that [her] "colloquium wasn't good."

As previously mentioned, all of the women who participated in my study are first-generation graduate students in their STEM fields. They indicated that some of the unfamiliarity and apprehension that they feel is related to that status. Bianca noted that she grew up in small, rural town in Middle America, a place she referred to as "a science desert." In addition to lacking information about and connections to science-specific resources, Bianca said that she did not grow up having "intellectual conversation": in her hometown, people mostly conversed with "a lot of small talk." Her experience, she felt, was much different than that of her peers who have said,

Oh, yeah, I grew up outside Prestigious University and was talking to these scientists all the time. When I was a little girl, I met all of these famous astrophysicists, so I worked in this group and that group. These titans in the field. I'm very close with them, and I've taken data for them when I was in high school. Or people would say, "I built a rocket when I was in middle school at a science charter school." There's all these experiences, and I was like, "Wow, I did not do any of that."

In comparing herself to her peers, Bianca felt that she was lacking “social capital.” Like Bianca, Daniela also shared that she had a “very informal background,” which she expressed has made it difficult for her to feel as confident as her classmates. Elizabeth also admitted that she has had similar crises of confidence despite having received numerous awards and fellowships and considering herself a successful graduate student.

In addition to discussing the imposter syndrome that they experience related to being first-generation graduate students in their STEM fields, the women also analyzed another manifestation of imposter syndrome, which they conceptualized as related to being either a woman or an underrepresented minority or both. Elizabeth divulged that she was afraid to ask for help [in her aerospace engineering lab] because she feared being seen as less competent or being stereotyped as a woman for not knowing how to use certain electronics or science equipment in the lab. Chelsea empathized and admitted that she also struggled because of her identity as a woman and an underrepresented minority student in her program. She said:

I wanted to come in strong and be like, “Well, I’m just new at this. I have some catching up to do,” but it’s really hard to ask for help when you know that you stick out, and you don’t want to admit that you’re behind because you just know you stick out.

Throughout their conversation, the women recognized the intersecting challenges that they have faced, and they agreed that it is difficult to pinpoint which issue they struggled with the most. As Chelsea shared, “It’s just hard to choose which one of those identity crises seems like is most affecting my day today.”

Bianca also raised the issue of “racial imposter syndrome,” which she had mentioned during her individual interview. Bianca, who identifies as half-white and half-Latina and describes herself as white-passing, has felt that her Latina identity has been

negated several times throughout her graduate school experience (e.g., not being included on a list of underrepresented minority scholars at a conference or being told that there are no underrepresented minorities in the room when she is there). However, at the same time, she recognizes that the challenges that she encounters in her program are distinct from and arguably less severe than the obstacles that other visible minorities in her program have to navigate.

Daniela (who as noted earlier, also identifies as Latina or Spanish, Native-American, and white of German ancestry) has experienced similar identity issues: although she identifies more with her Latina background, which was more predominant during her upbringing, she cannot speak Spanish. In conveying her feelings about her bicultural identity, Daniela said:

I feel a little dishonest sometimes when I say that [I'm Latina] because I'm not full, and I don't speak Spanish. But, then, it doesn't feel right saying that I'm white either...and not identifying with either. Then, moving here, I lived in one of the immigrant communities when I can't speak it [Spanish]. Any of my neighbors, they think I can, and it just reinforces this weird place that I am in.

Daniela describes her identity as “social and ethnic purgatory.” The conflict that she chronicles has also affected her ability to connect with other students and find support through institutional resources on DMV University's campus.

In defining her own racial identity, Chelsea, who is biracial said:

I've always been really adamant about not choosing one in any particular situation. I'm half black, and I'm half white; and that's what it is. I think people should recognize both. It's also different for me . . . I don't pass as white. People just assume I'm black or something else, so I have to deal with that, as well. The default is to think that I'm black – 100% black – and that's how I'm treated by people that don't know me.

Bianca, Chelsea, and Daniela all indicate that the lack of the diversity is also problematic at the faculty level of their departments: even the professors who are not

Caucasian are international rather than from traditionally marginalized populations of the United States. In describing the diversity (or lack thereof) in her department, Bianca said:

So, it's not that there's a lack of representation, but the representation of under-represented minorities in my department happens to be very white. [In other words, there are few visible underrepresented minorities.] It just feels like [there's] something really wrong with that. You can be a certain type of minority [e.g., with a certain look, from certain countries of origin, from a middle-class or upper-class socioeconomic background, etc.] that they'll allow. I don't know how to explain it. It's a problem, and especially at the faculty level, too.

Although all of the women acknowledge that resources exist on DMV University's campus to help women and underrepresented minorities in navigating these challenges, the extent to which they have taken advantage of them or indicate that they have been helpful varies. While Bianca shared that she recently attended an informative event that focused on multiracial heritage, Daniela voiced discontent about the lack of support for invisible minorities (both racial/ethnic minorities who are white-passing as well as minorities who come from disadvantaged socioeconomic backgrounds whose minority status is not immediately apparent) and admonished DMV University for not better advertising the services that are offered.

In commenting on the support available for women in STEM, Elizabeth, a white woman, applauded both her department and college's women in STEM organizations for providing her with opportunities for professional and peer networking; however, Chelsea, a biracial woman, shared that after two years in her master's program, she has not made one woman friend in her program or department because the students in her program are predominately international males. Chelsea said, "I'm used to being the only black person in a situation, but it's harder when I'm the only black and the only female person that I see

all day every day.” The lack of gender and racial diversity in her program and department, she shared, also has contributed to her feeling like an imposter in her program.

The women each stated multiple times during the focus group session that the discussion was helpful: the women shared that it not only validated their feelings but also provided an opportunity for them to connect with other underrepresented minority and first-generation women graduate students in STEM programs. Chelsea said, “It just helps to know that you’re not alone in what you’re thinking,” and Elizabeth agreed, “it helps to hear that other people feel this way.” Daniela added, “That was the biggest thing for me, was feeling like I was alone and feeling like I was the only one dealing with all of this stuff.” At the end of the focus group, Daniela took Chelsea and Elizabeth’s phone numbers and invited them to join the small cohort that she and her two women graduate student friends have created: they share online resources with each other, go swimming and exercise together, and encourage each other to persist in their graduate programs.

In addition to sharing contact information with each other, the women discussed strategies and coping mechanisms that they each employ to handle the various forms of imposter syndrome with which they are afflicted. These solutions that the women mentioned included resources on campus, such as the women in STEM student organizations, going to therapy, reviewing their curricula vita to remind themselves of their accomplishments, minimizing the importance of other people’s opinions or evaluations of them, and connecting with other students.

In addition to the multiple manifestations of imposter syndrome that the women discussed during the focus group session, they reported various instances of suspected gender bias. For example, although Alma cannot say with certainty that her issues with her

advisor were a result of gender bias, she does hypothesize that it was a part of the problem. Chelsea also questions whether gender bias could explain the unwarranted comparison that her advisor made between her and another woman student who dropped out of the program despite Chelsea never having given any indication of her intention to do so. Elizabeth too indicates that she experienced gender bias during her program when her advisor nominated another student for a departmental award that she was more qualified to receive.

Conversely, the women noted that in the midst of the challenges with their graduate STEM programs they have simultaneously received accolades and awards, which together constitute a culture of contradictory support. For example, Alma's advisor was criticizing her research while, at the same time, she was being nominated for a teaching award by another faculty member and being told by yet another professor on her committee that his "yes" to her proposal exam was the easiest approval that he's ever given. Elizabeth also referenced similarly contradictory support: her advisor would not nominate her for a departmental service award because he wanted to nominate another less qualified student who needed funding, but he did nominate her for a university service award that she felt she was unqualified to receive.

Concluding Thoughts

Navigating these contradictory experiences within the university has been a challenge for all of the women participants. A computer science professor and previous administrator's comments about and perspectives on this contradictory institutional support are characterized by same inconsistency that he criticizes. The professor acknowledged that both his department and DMV University in general did not actually

provide the support for underrepresented minorities or women students that they promised.

In commenting on this disconnect, he said:

We give lip service, and we pander to a lot of statements; and I think it's bullshit. I think they're not sincere, and the practices do not follow what we say. We should at least be honest. If we're not providing it to people, we should just say it and not try and snow people.

Although the professor criticizes the lack of support offered to women and minority students, he simultaneously questions the types of support needed. He expressed genuine interest in helping all of his students to succeed within their field of study; however, he questioned the need for differentiation in both the types of support offered or recognition given. Instead, he suggests that professors should be facilitating opportunities for students to “build relationships around a core identity” of “scientist” and offering support related to learning the material and coursework, or “focusing on the tech,” rather than providing women and underrepresented minorities with specific gendered or racialized support.

Another concern that all of the women mentioned was balancing their bicultural identities. The bicultural identities that the women described also have multiple manifestations, which include bicultural or biracial self-identification and balancing a dual culture (home versus university or STEM cultures). Although each woman's challenges with managing the multiple aspects of her bicultural identity are unique, the women are united in expressing their need for greater support from the university in navigating them.

Throughout the individual interviews, each participant expressed a need for additional types of support. The conversation during the focus group echoed this desire. The types of additional support discussed ranged from more opportunities to connect with women in graduate STEM programs to candidly discuss gender bias and imposter syndrome, to targeted support for first-generation graduate students that expands beyond

gaining access to graduate degree programs, to more inclusive diversity support that incorporates a wider variety of socioeconomic statuses and concerns as well as broader definitions of racial and ethnic diversity and issues. The next chapter examines these issues in greater detail and provides recommendations for more adequately addressing them.

CHAPTER SEVEN: DISCUSSION AND IMPLICATIONS OF INDIVIDUAL AND INSTITUTIONAL CULTURE

Introduction

This chapter elaborates on the findings of this study, which indicate that although students place a high value on community cultural wealth in accessing and persisting in their STEM degree programs, these assets must be coupled with complementary institutional support, which the women report is lacking. The participants in this study self-identify as first-generation graduate students (at least one of their parents has an undergraduate degree) and underrepresented minorities (although some of them are minorities within STEM but are not from historically underrepresented populations), and their experiences raise the questions: What do these findings suggest about the efficacy of higher education diversity policies and best practices? What implications can be inferred about the experiences of underrepresented minorities and first-generation women college students in graduate STEM programs? What questions do the findings elicit about the terms underrepresented minority and first-generation students?

Much of the existing literature on underrepresented minority students and first-generation college students examines higher education issues from a deficit perspective. This perspective is especially pervasive in the contemporary literary canon that discusses underrepresented minority women and first-generation women college students' experiences in STEM fields. This study reframes that discussion by investigating what assets and strengths underrepresented minority and first-generation women graduate students drew upon from their community cultural wealth (including funds of knowledge) to graduate from college and both gain access to and navigate through graduate degree

programs in their STEM fields. In addition to examining these individual factors, the study also documents the institutional factors that the women identified as having contributed to their graduating from college and moving onto graduate programs in their STEM fields and analyzes the level and type of support provided. Finally, this study offers greater insight into the similarities and differences that women students experience in navigating their higher education institutions. This chapter discusses the findings from this study's three guiding research questions, which were presented in the three previous chapters. In addition, this chapter also shares observations about the participants and their educational experiences in relation to the descriptive terminology used to define the population of underrepresented minority and first-generation students from which this sample was drawn.

Strengths of Community Cultural Wealth

The *testimonios* from the five women participants in this study (Alma, Bianca, Chelsea, Daniela, and Elizabeth) provide evidence that shows how underrepresented minority and first-generation graduate students use the assets from their community cultural wealth to successfully navigate the challenges that they encounter both in accessing and participating in STEM higher education programs. Together, these narratives suggest that the women participants have had access to concrete forms of cultural capital through their community cultural wealth that not only instilled in them the value of education but also supported their interest in their specific STEM fields and, in the case of Elizabeth's father's social capital, also provided them with access to STEM social networks. This finding is contrary to previous literature written about underrepresented minority and first-generation college students, which contends that their families cannot

provide them with the cultural or social capital needed to pursue STEM fields (Archer et al., 2012; Martin et al., 2013; Ovink & Veazey, 2010).

Assets of the women's community cultural wealth were also important to facilitating their upward mobility in education and academic trajectories in their STEM fields. Alma, Chelsea, Bianca, and Elizabeth's *testimonios* illustrate the ways in which their families have provided tangible support and either made sacrifices or were willing to make sacrifices to facilitate their daughters' academic pursuits and progress. Alma's parents were willing to take out a loan (akin to the cost of a home mortgage) to finance her attendance at her dream graduate school program when she did not receive any funding with her acceptance. Although Alma was not comfortable with her parents accumulating so much debt on her behalf, she recognized the generosity in their willingness to make such a substantial financial sacrifice. Chelsea shared that her parents also made sacrifices in order to send her to a private college preparatory high school in another neighborhood that would provide her with a much better academic preparation than her local public school. In addition, Chelsea attributed her graduate school acceptance in part to the countless hours that she spent on the phone with her mother who offered both emotional support and whatever assistance she could in helping Chelsea to prepare her application materials. Bianca noted similar sources of familial capital and also conveyed how her family's aspirational capital, including her parent's words of encouragement and her grandfather modeling the importance of lifelong learning, motivated her to apply to graduate school. In addition to having aspirations for her, Elizabeth's father worked two jobs to pay for her undergraduate degree, so she would not have to take out any school loans, which made the prospect of graduate school seem less financially daunting.

The women's *testimonios* also highlight the ways in which they capitalized on their various forms of community cultural wealth at multiple points during their academic careers: they used these assets both to gain access to and persist in graduate school. Daniela and Elizabeth reported that education is a valued asset within their familial capital, and Bianca and Chelsea shared that their families also demonstrated the importance of education by setting examples for them: although Bianca's grandfather had only minimal formal education, he was a self-directed lifelong learner who encouraged his granddaughter to do the same, and Chelsea's mother, despite being a full-time working professional and mother of young children, completed her undergraduate degree.

Daniela and Elizabeth's narratives show how their familial capital not only fostered their love of and appreciation for education but also cultivated their interest in their chosen STEM fields. Daniela attributed her interest in her STEM field directly to the camping trips that she took with her family as a child: these trips introduced her to nature, which served as a refuge for her during difficult times, and she consequently developed a desire to protect the environment in the same way that it had sheltered her. Elizabeth also recalled that her interest in aerospace engineering developed after taking trips with her family to Godard Space Flight Center in Florida and from visiting her dad, who worked a blue-collar job, at NASA. In addition, Elizabeth spoke about how her father's social connections at NASA played a role in her being hired for her first internship in her field.

All five of the women participants reported having applied various forms of their community cultural wealth to successfully navigate the challenges that they experienced during their graduate degree programs. Both Elizabeth and Alma describe how their familial capital contributed to their persistence in their graduate degree programs by

providing them with material and emotional sources of support. After Elizabeth moved to another state to live with her husband and traveled back and forth to graduate school, Elizabeth's parents and grandparents cooked for her and provided her with housing and transportation when she traveled to DMV's campus. Alma's family supported her in similar ways during her graduate degree program, and she discussed multiple examples of her strong family bonds, as well as cultural sayings that both reify and reflect the value of "family comes first." For example, Alma's uncle cosigned for an apartment lease for her, and her mother flew across the world to cook her food and offer positive encouragement when she was depressed after encountering difficulties with her advisor and funding. In addition, Alma shared that she has been comforted by her boyfriend and her parents' constant reassurance of her ability to succeed throughout her program.

Chelsea, Bianca, and Elizabeth successfully navigated challenges during their graduate STEM programs using their familial capital. For example, Chelsea had difficulty with some of the material in her computer science classes because of her lack of basic knowledge about the mechanics of the computer; but her father, who works in IT, was able to explain some of the fundamentals to her, and she was able to apply this information to her more complex coursework. Part of Elizabeth's familial capital is their value of frugality and skills in managing money. Her family taught her both the value of money and skills for saving, which have helped her to be resourceful and maintain a comfortable lifestyle as a graduate student on a meager budget.

Bianca explained how her linguistic capital and funds of knowledge not only helped her to persist in her graduate program but also gave her an advantage over her classmates in learning computer programming languages. Bianca did not consciously apply her

Spanish language skills to her coursework, but she recognized the important support that they provided her when she reflected on her experience in her STEM program during conversations with her mother. Her familiarity with and ease in learning languages is part of her funds of knowledge or the cultural knowledge and skills that she brought with her to the classrooms of her STEM degree program.

In addition, Bianca and Daniela shared how their navigational capital manifests in the form of agentic perspectives that they adopt as guiding frameworks and positive coping mechanisms. For example, whenever Bianca is having a difficult time in her program, she compares her experience to that of her family in Latin America and reflects on the opportunities that she has available to her. Rather than an attitude of gratitude, Daniela uses the cautionary tale of her mother's mental health crisis to remind herself to always prioritize her health and well-being even if that prioritization is at the expense of her productivity.

All five women attribute their valuing of education and specialized STEM interests to assets of their community cultural wealth. Furthermore, the women identify the many ways in which their familial capital, their family's social capital, their linguistic capital, and their navigational capital are valuable resources that have contributed both to their persistence and success in their graduate STEM programs. This finding provides evidence contrary to the literature on underrepresented minority and first-generation college students' experiences in STEM fields and suggests that these students have access to concrete forms of capital that support them gaining access to as well as persisting and achieving success in advanced levels of highly specialized and technical STEM education.

These findings add to the existing literature on first-generation college students and expand Espino's (2014) findings, which describe the extent to which Mexican American first-generation doctoral students can apply their community cultural wealth to gain access to and persist in their graduate degree programs, to other underrepresented minority first-generation women graduate students. Espino (2014) contends that students' community cultural wealth had value during their secondary schooling and undergraduate education but "had limited currency" in graduate school (p. 568). While the findings from this study support Espino's (2014) argument that higher education institutions need to place greater value on the assets with which underrepresented minority students come to school and better incorporate elements of students' "home, family, culture, community" into the institutional culture, they also provide evidence showing how the students' assets of community cultural wealth were not only of value but arguably priceless to their success in their graduate STEM programs (p. 571). The women's *testimonios* highlight how the various assets of their community cultural wealth were essential supports to their gaining access to and achieving success in graduate school.

Limitations to Community Cultural Wealth

Although the women's community cultural wealth provided them with invaluable support, the findings from this study also describe challenges that could not be remedied with these assets alone. These findings echo some of the challenges previously reported in the deficit literature on underrepresented minority and first-generation college students, which asserts that these students encounter challenges both in accessing and participating in higher education programs, particularly in STEM fields (Beasley & Fischer, 2012; Chang et al., 2011; Hill, Corbett, & St. Rose, 2010; Shaw & Barbuti, 2010). The women

all recognize that they encountered more obstacles and that they required additional institutional support in comparison to their peers in their undergraduate and graduate STEM programs.

For example, Bianca admitted that her upbringing did not include the STEM resources to which her undergraduate and graduate school classmates had access. In fact, she referred to her rural hometown as “a science desert,” in comparison to some of her classmates who “built a rocket when [they were] in middle school at a science charter school.” In describing an analogous disconnect with her peers, Daniela said that she has never met anyone who came from a background similar to her own in her degree programs. This lack of role models may have contributed to her never imagining the possibility of her own academic success. She revealed, “Where I am now I thought was totally unreachable when I was growing up. It feels surreal to me sometimes.”

Another challenge that the women shared was that their parents were unable to provide them with concrete guidance about the application process to or experience in graduate school despite the fact that at least one of their parents had graduated from college; all of the participants in this study have at least one parent who completed a bachelor’s degree. In fact, the mother of one of the participants also has a master’s degree in teaching; however, she pursued both her undergraduate and graduate degrees at the local college later in life while raising children and working full time. Although each of the women’s parents had some experiential knowledge and were able to offer limited advice about college, all of the women reported experiencing difficulties when applying to and participating in graduate school. In discussing these difficulties, Bianca said, “they weren’t able to help me apply to grad schools; they weren’t able to tell me what it would be like. They had no idea

that I could get paid to go to grad school.” Elizabeth echoed Bianca’s sentiments in detailing her own experience applying to graduate school: neither she nor her parents were aware of funding opportunities available to graduate students through tuition remission, fellowships, stipends, etc. Alma noted similar difficulties, which were compounded by her parents’ limited English proficiency. Chelsea admitted even struggling during her undergraduate application process because, as she said, “For undergrad, my parents had a different experience with college. They didn’t apply to eight schools; they were figuring it out with me.”

The Strengths, Limitations, and Contradictions of Institutional Support

Previous studies that analyze these issues through a deficit perspective fault the individual student and her family for any shortcomings. This study suggests reason to question this perspective and presents a counternarrative that highlights how institutions of higher education can and should be more responsive to students’ needs. Familial and aspirational capital were important factors in the women participants gaining access to their graduate STEM programs; however, Elizabeth, Daniela, and Bianca shared that both formal and informal institutional support was necessary for their acceptance. In fact, all three of the women would never have applied to graduate school had a faculty member not discussed graduate school with them and encouraged them to do so. One of Elizabeth’s undergraduate professors emailed her to ask about her plans for graduate school and suggested that she consider applying. Prior to having conversations with this professor who told her about possible funding opportunities available to graduate students, Elizabeth had not intended to go to graduate school. In addition to the encouragement from a faculty member, Daniela received substantial support from formal institutional resources: two

national programs for underrepresented minority students, one that is designed to support students in transitioning from a community college to a four-year degree program and another that assists students in applying to graduate school. However, Daniela said that she only became aware of these institutional resources through “word of mouth.” Although Daniela attributes her undergraduate and graduate school acceptance to the support that she received from these two institutional resources, her *testimonio* also highlights the importance of the personal connections and social networks that students make at universities.

While Bianca was also encouraged to apply to graduate school by one of her professors in her undergraduate degree program, she shared that her friendship with a classmate and the support that she received from this friend and her family was the most important component in her successful application to graduate school. Although her university had a panel about applying to graduate school, Bianca said the social capital that she found through her peer network was more helpful: her classmate’s father counseled Bianca on the graduate school application process, and her friend shared resources such as GRE study materials with her. Bianca’s parents were supportive of her furthering her education, but they were unable to provide her with concrete guidance. In other words, although Bianca had familial capital and aspirational capital, which encouraged her to persist in her academic endeavors, she needed institutional support to help her convert her family’s value of and aspirations for her education into concrete actions

The three biggest challenges that all of the women encountered in their graduate STEM programs were managing their imposter syndrome, dealing with the contradictory support at DMV University, and balancing their bicultural identities. Imposter syndrome,

one of the challenges that each woman mentioned, could not be addressed with the assets from their community cultural wealth alone. Bianca, Chelsea, and Daniela described their experience with imposter syndrome in sharing that they sometimes feel less proficient than their classmates regarding field-specific technical knowledge, which makes them anxious to discuss their research in a group setting or in meetings with their professors. In fact, both Daniela and Bianca admitted that their professors encouraged them to expand their science vocabulary. The three women (Bianca, Chelsea, and Daniela) quickly related to each other during the focus group session when revealing how these conversations further solidified the feelings of inadequacy that they have when they compare themselves to their male classmates.

Alma and Elizabeth also voiced that they have experienced similar self-doubts. Alma shared that one of her papers was recently accepted to a top conference in her field, which is an important and noteworthy accomplishment; however, the day before she received this news, she had cried to her boyfriend and confessed that she felt that she did not deserve her forthcoming degree because she had not accomplished enough. Alma believes that most women in her field have these crises of confidence. She confided that a more junior woman in her program approached her with similar concerns about her own progress and success. Alma and Elizabeth agreed that the contradictory support provided by department faculty has exacerbated their feelings of self-doubt. For example, Alma had drastically divergent experiences with two faculty members in her department: one professor nominated her for multiple awards while another, her previous advisor, simultaneously ridiculed her research. Elizabeth's experience is similarly confusing: although faculty selected her to serve in departmental leadership roles, they did not

nominate her to receive recognition for that service. All of women shared anecdotes about the crises of confidence that they have experienced during their graduate STEM programs, and four of the five women used the specific term “imposter syndrome” to describe their feelings of self-doubt about their abilities to succeed within their graduate STEM programs.

While having a term for these feelings and connections to a network of other women who admit also having experienced them are helpful, neither has offered a solution to the problem. In their *testimonios*, the women discussed various institutional resources that were available to them and evaluated their utility. For Alma (an Arab woman and international student) and Elizabeth (a white woman), the women in STEM student organizations were very helpful resources. These meetings served as a space for Alma and her women colleagues to discuss gender issues that they encountered, such as biases and imposter syndrome. Alma was also particularly impressed that the Women in ECE organization had opportunities to invite both male classmates and faculty members to events to learn about the gender issues that exist in the graduate program and field. The student organization meetings also provided Alma with opportunities to network with other international women students. Mentoring (Big Sister, Little Sister Program) was also a component of the organization, and Alma’s peer mentor (her “Big Sister”) both welcomed her and helped her to integrate into the program and adapt to a new life in the United States. This benefit echoes the findings of Bhatia and Amati’s (2010) study on peer mentoring for women graduate students in engineering at Syracuse University: they suggest that peer mentoring “offer[s] a way for international students to become culturally assimilated into university life as a graduate student in the United States” and also facilitates their learning

of new cultural norms while helping them “handle the stresses associated with adapting to cultural differences (p. 181).

Like Alma, Elizabeth also found great support in DMV’s WIAA student organization. Through this group, she saw role models of women working in her field who provided her with a sense of belonging and who reassured her about her identity as a woman in aerospace engineering. In fact, Elizabeth shared that the first time that she ever saw a woman with a PhD who both looked like and presented herself as someone to whom she could relate was at an event held by this organization. The events also offered Elizabeth her first opportunity to network with experienced women professionals in her field. Although she was excited to connect with women in her field, Elizabeth was disappointed by their lack of concrete guidance about maintaining a work-life balance after graduate school. Rather than through this formal mentoring channel, Elizabeth found more support through her informal network: the new friendships that she has made with other dual-career couples in New York.

Similar to Elizabeth, Bianca found the women’s group to be a good formal institutional resource for discussing gender issues within her field, but she found that her informal peer mentor (a woman of color in her program) offered more and better guidance about how to handle the challenges related to the gender inequity and lack of diversity that she encountered during her graduate program. Elizabeth and Bianca’s assessments of the women in STEM organizations support the arguments that Bhatia and Amati (2010) make in their study on graduate peer mentoring for women in engineering. In applying research from Chesler and Chesler (2002), which evaluates various types of mentoring for women in engineering, and Chesler, Single, and Mikic (2003), which focuses on the advantages of

peer mentoring for women faculty, Bhatia and Amati (2010) suggest that “peer mentoring is more likely to meet the support needs of women in engineering than hierarchical mentoring relationships” (p.176). Both Elizabeth’s reflection on the importance of visible role models and Bianca’s preference for working with her informal peer mentor support Chesler and Chesler’s (2002) claim that “young people generally prefer to work with mentors and role models who are like themselves (probably because they perceive that these models will have experienced difficulties and challenges similar to their own)” (p.51).

Both Bianca and Daniela conveyed their shared desire to engage with students who have had similar experiences. While Bianca found support through institutional resources available at DMV, Daniela did not. Bianca joined a Graduate Diversity Discussion Group and indicated that it provided her with an excellent opportunity to interact with a more diverse group of students than her classmates in her program or department. Daniela did not find the university’s diversity resources to be representative of or helpful to the wide range of diversity among students. Instead, she felt that the informal social network that she made in graduate school has provided her with better support than any formal institutional diversity resources. Although Daniela acknowledges that DMV University offers diversity support to students, her perception is that the resources available are neither representative nor inclusive of the diversity at the university and therefore do not address the full spectrum of students’ differentiated needs. In Daniela’s experience, the support services are targeted to specific minority groups, and the majority of students who attend the events come from affluent backgrounds, unlike her own. Daniela noted that the diversity events were only helpful because she made a connection with another graduate

student, Monica, who has become her cheerleader: she encourages Daniela to persist in her program and reassures her of her success. Along with Monica, Daniela and one of her classmates, have developed their own graduate support group: they send each other online resources, go swimming together, and motivate one another.

Although Daniela did not find the support that she needed through DMV's institutional resources, she has created her own peer support network. Chelsea admitted that she has not been as fortunate as Daniela to find other women in her graduate degree program with whom she could connect. During the focus group she mentioned that she does not have one female friend in her program. In fact, Chelsea indicated that she volunteered to participate in this study because the qualifications for participants fit her perfectly and because she did not "know any other grad student in [her] department that is a woman and a minority." Bianca offered similar anecdotes about her department and academia in general in noting that the only visible minorities that she sees in her department are the service workers, which makes her feel that her STEM program and in academia in general are sending the message to students that "you can only belong if you look a certain way." This message is contradictory to Bianca's initial perception the diversity in her program: initially, Bianca was very enthusiastic about having a Latino professor in the department; however, she now acknowledges that he too is white-passing. For this reason, Bianca, who also describes herself as "white-passing," struggles with whether to make her Latina background known and questions whether her professors' perception of her work would change if they knew about her identity. In her *testimonio*, Bianca alludes to double discrimination: as a white-passing Latina woman, Bianca she has encountered discrimination both from the white students, who have undermined her achievements by

suggesting that her underrepresented minority status has been the reason for her success rather than her own effort and ability, and from the other Latino students, who have made comments about the legitimacy of her underrepresented status as a white-passing Latina woman.

While balancing her bicultural identity has been an arduous process for Bianca, she acknowledges that the challenges that she has experienced are less severe than the obstacles that visible underrepresented minorities encounter. Elizabeth echoes this sentiment in discussing her experience as one of a few women at an international conference in noting that it must be difficult for women who are “double minorities” (i.e. women of color) who may be one of a few women and one of a few minorities. Chelsea voiced this exact feeling about her own experience in her graduate STEM program when she said: “I’m used to being the only black person in a situation, but it’s harder when I’m the only black and the only female person that I see all day every day.”

Although Chelsea describes herself as a “black person” in the quote above because that is the way that people perceive her, she actually self-identifies as biracial. In describing herself, she said, “I’m half black, and I’m half white; and that’s what it is. I think people should recognize both.” As previously discussed, Bianca and Daniela, who are also bicultural, indicated that they have also struggled to receive both recognition of and support in balancing their bicultural identities. Bianca, Chelsea, and Daniela’s experiences confirm the findings presented in Tate and Lin’s (2005) study, which applied a multiple identities framework to examine women of color engineering students’ experiences. Tate and Lin (2005) contend that underrepresented minority women in STEM have multiple identities: academic, social, and intellectual, and that it is necessary to examine each identity

individually and the intersections among them to both understand and improve underrepresented minority women's experiences in their STEM programs. Although the five women of color participants in their study were engaged in their coursework and persisted throughout their degree, Tate and Lin (2005) noted that they reported being "plagued with feelings of difference and a sense of not belonging" (p. 491). Bianca, Chelsea, and Daniela admit to having similar feelings, and through their *testimonios*, suggest that the culture of the university exacerbated rather than ameliorated these feelings of not belonging.

Although Alma and Elizabeth do not self-identify as bicultural women, they do describe challenges with balancing dual cultures: the culture within their STEM programs and their home cultures. Both women share that despite their family's support and encouragement, they have difficulties discussing the technical aspects of their research with them because they are a non-technical audience. For Elizabeth, the divide between the liberal and progressive values that she has adopted as a student at DMV University and the conservative values that her family cherishes compounds that challenge. Another layer of the duality with which Alma struggles is the fact that her home language (Arabic) and the language of her STEM field (English) differ. Although both Alma and Elizabeth recognize the duality of their university and home cultures, they do not see them as mutually exclusive. Daniela also refers to having dual cultures and indicates that she maintains her home culture totally separate from her school culture while remaining equally active in both. Daniela's response to her bicultural identity reflects the concept that LaFromboise, Coleman and Gerton (1993) call "a divided self" (p. 395).

In discussing their individual cultures, the women all shared knowledge, experiences, skills, values, and/or practices that they brought with them to college and graduate school; however, the boundaries of their home and community cultures varied. For Alma, her home culture included her aunts, uncles, and cousins in addition to her immediate family, and for Bianca, her home culture extended beyond her immediate family to her rural community and across the border of the United States to her family in Latin America. Bianca and Chelsea noted the ways in which their dualistic ethnic or racial backgrounds were characteristic of their home cultures. Although Daniela also described having a similar multicultural background, she shared that her family's socioeconomic status and the resilience that she learned in navigating the challenges that she faced while growing up in a low-income neighborhood community have been more important factors to her identity formation. While the women all referenced some of their demographic factors as being important parts of their identities and individual cultures, the most salient factor varied among them.

Applying Nagel's (1994) discussion on ethnicity helps to explain the women's differentiated depictions of their individual cultures. Nagel (1994) describes ethnic culture as a "shopping cart" that each individual fills with the items that she selects from the "shelves" of her background and current life experience (p. 162). Some of the items that Nagel (1994) lists include "art, music, dress, religion, norms, beliefs, symbols, myths, customs" (p. 162). In extending this metaphor to the participants in this study, it is important to note that some of the women indicated that their ethnic identifications were predominant pieces of their individual cultures (e.g., Alma and Bianca); however, Chelsea, Daniela, and Elizabeth shared that other elements took prominence in their self-

identification (e.g., Chelsea indicated race while Daniela and Elizabeth referenced socioeconomic status). Furthermore, the women describe how they use the items that they select to gain access to, navigate through, and achieve success in their graduate STEM degree programs.

Nagel (1994) outlines how people's definition of and alignment with ethnicity are "mutable" and depend on internal and external factors. For example, Nagel (1994) explains how a person may describe herself in multiple ways depending on the social situation in which she finds herself. For example, an American Indian or Latina woman, in the company of people who do not self-identify as American Indian or Latina, may identify only with these broad categories; however, if she is with other people who self-identify in a similar way, she would likely indicate a particular tribal or specific ethnic affiliation. Both Bianca and Daniela highlight these nuances in defining their individual cultures. Daniela describes one aspect of her multicultural background using multiple terms (Latina, Spanish) throughout her *testimonio*; however, when she attended an event on DMV's university campus for Latina students, she found that even though some of the students came from similar ethnic backgrounds, none of the students shared her socioeconomic background. So, although they may share ethnic origins, their household cultures are very different. Similarly, Bianca, who also identifies as Latina and white, pointed out how her definition of her individual culture varies. For example, Bianca's rural midwestern origins set her background apart from other white students; however, at the same time, her Latina background also differentiates her experience from her other people in her rural midwestern community. Although most of the women in this study describe themselves as multiracial or multiethnic, they highlight certain aspects of their backgrounds as the most

salient to their identities and individual cultures, and these aspects vary depending on internal and external factors.

Although the students admit that balancing their dual cultures has come with challenges, none of the women graduate students report having followed Tinto's (1988) model of student retention, which requires students to disassociate from their previous communities (separation), then familiarize themselves with the beliefs and behaviors of their college peers (transition), and finally, fully integrate themselves into the collegiate community by adopting these new beliefs and behaviors (incorporation) in order to succeed in persisting and completing their degrees. Rather than viewing their cultural differences from their classmates as impediments, the women all shared that the assets of their community cultural wealth have provided them with support even at the graduate levels of very specialized technical degree programs. Despite the fact that the assets of their community cultural wealth are invaluable to them, the students also revealed instances in which they needed supplementary institutional support; however, their perspectives on the efficacy of the support available vary substantially. Daniela and Bianca concurred that both formal and informal support networks were invaluable to their acceptance into graduate school and complemented their familial and aspirational capital. Additionally, while Alma and Elizabeth's familial capital provided them with important physical and emotional support and is the asset to which they attribute their successful handling of many challenges during their graduate degree programs, they also sought institutional support for balancing the dual cultures of their home lives and school lives. However, their experiences with this institutional support were different: Alma received excellent mentoring through her department's women in STEM organization about assimilating into life in the United

States, but Elizabeth found only limited concrete support on the work-family balance issues for which she sought guidance. With regard to managing their individual bicultural or biracial identities with which they sometimes struggle, Bianca, Chelsea, and Daniela indicated that the institutional support for this specific issue is nonexistent: although DMV offers formal institutional diversity support resources, none of them have met the students' specific needs. Rather than following Tinto's (1988) model of student retention, the women seek to maintain their bicultural identities and continue to demand support from their institution in doing so.

Implications for Practice

The application of feminist standpoint theory and the conceptual framework of community cultural wealth provided a frame with which to examine the similarities and differences between five underrepresented minority and first-generation women graduate students' experiences in their STEM programs and the extent to which their family values, knowledge, skills, and resources supported their success in their advanced and highly specialized fields of study. Although much of the family and community support was personal or emotional, Bianca shared how her linguistic capital (Spanish language skills) and funds of knowledge (ability to learn other languages) not only encouraged her interest but also gave her an advantage over her classmates in learning computer programming.

The application of Wieman (2012) offers a suggestion for one way that educators can build on connections, like the one that Bianca describes, to transform STEM classrooms. Wieman's (2012) article investigates transformative teaching practices that can cultivate more effective learning processes in STEM classrooms; although he focuses primarily on K-12 education, he also references undergraduate education Wieman (2012)

explains that “effective STEM teaching is a specific learned expertise that includes, and goes well beyond, STEM subject expertise” (p. 28). Wieman argues that “pedagogical content knowledge” might even be more important than STEM specific knowledge and involves “an understanding of how students learn particular content and the challenges and opportunities for facilitation of learning at a topic-specific level” (Wieman, 2012, p. 28). Within the literature, numerous studies evaluate a variety of initiatives developed over the past few years to bridge students’ cultural knowledge and STEM concepts in K-12 classrooms (Dalvi, Wendell, & Johnson, 2016; Nasir, Hand, & Taylor, 2008; Subramaniam, Ahn, Fleischmann, & Druin, 2012). The application of Wieman’s (2012) implications for teaching opens the discussion to making similar connections in undergraduate and graduate STEM classrooms. These recommendations include: “building on learners’ current thinking to move them to higher expertise”, “making the subject interesting, relevant, and inspiring”, and “developing a sense of identity in the learner as a STEM expert” (Wieman, 2012, p. 28).

Bianca’s *testimonio* provides a rationale for the implementation of the types of pedagogical transformations to which Wieman (2012) refers in advanced postsecondary education STEM coursework. In relaying the connections that Bianca makes between her linguistic capital and her STEM coursework to an engineering program director and faculty member at DMV, he said that he recognizes that an association exists between language learning (students’ funds of knowledge) and computer programming, but he does not elaborate on it in his classroom or encourage students to do so.

In analyzing this situation through the lens of transformative practice that Wieman (2012) prescribes for university level STEM classrooms, I note that an opportunity exists

to build on students' knowledge, enhance the relevancy of course material, and encourage students' mastery. Although instructors possess expert subject matter knowledge and must convey it to their students, this example shows how they can overlook connections between students' funds of knowledge and STEM course content, which could assist in engaging students in the course material and facilitating their learning process. In acknowledging this issue, Wieman (2012) discusses two common misconceptions that exist at the postsecondary level: (1) instructors' only responsibility is to convey the course content to their students, and (2) the extent of student engagement is determined by the student alone.

Although students at the graduate level already possess advanced interest in many of their STEM course topics, incorporating connections, such as the one that Bianca describes between her Spanish language skills and computer programming coursework, could help to facilitate students' learning and mastery. In addition, allowing students like Bianca to serve as instructional assistants or guest experts in presenting these connections to their classmates could be an opportunity for what Litzler, Samuelson, and Lorah (2014) call "performance accomplishments, also known as mastery experiences" (p. 816). These "mastery experiences" could be beneficial for underrepresented minority and first-generation women graduate students, who all reported experiencing feelings of imposter syndrome, by "function[ing] as behavioral factors informing self-confidence and self-efficacy beliefs (Litzler et al., 2014, p. 816).

In addition to imposter syndrome, the women reported challenges related to the lack of support for diversity and inclusion both in their graduate STEM programs and on DMV's campus in general. In their *testimonios* and in the focus group session, the women conveyed their desire to interact with other women who have had similar experiences as

their own; however, they also recognized that the diversity in their fields (and perhaps on campus in general) is still lacking. DMV claims to have a focus on diversity and inclusion and offers a wide range of seminars and workshops across its campus, yet faculty suggest that there is little buy in. For example, an engineering faculty member and program director shared that he attended a college-wide event on gender bias and, “only 12 people came.” In discussing the policies and practices available to support underrepresented minority and first-generation women graduate students in STEM, he said: “Yeah, we need to do more. As an administrator, we need to do more, but as you can tell, I don’t. I’m interested in them [policies and best practices], but the amount of time we spend worrying about this issue [diversity] is small.” With these observations in mind, DMV University should not only focus on its capacity to recruit a diverse group of graduate students (underrepresented minorities and first-generation college students) but also the will of its faculty, staff, and students to make the climate welcoming and inclusive.

Both Alma and Daniela detail multiple issues that occurred with professors and suggest that other department faculty and administrators accept these issues as part of standard operating procedure in the university culture. For example, Alma had a contentious relationship with her advisor: he dismissed her research ideas; he listed her as a second author on publications; he did not tell her when he lost funding for her, and she had scramble to find another source of financial support on campus. Then, after changing advisors, her previous advisor asked her to be a teaching assistant for him. Although the department chair agreed that the professor should have handled the funding situation differently, no consequences existed for his actions or lack thereof. Daniela also had a predicament with the professor for whom she was a teaching assistant, and while other

department faculty members and administrators agreed that the professor had unrealistic demands and lacked appropriate understanding about Daniela's family emergency, they advised Daniela not to complain too much and to simply focus on getting through the year. Although the university offers recourse for students who have disputes with faculty, the unwritten norm is that students will not take advantage of them except in extreme circumstances. Rather, one of the unspoken tenets is that faculty members will not question another faculty member's authority in her own teaching or mentoring. In their *testimonios*, the women participants explain how these unwritten norms and unspoken tenets of university culture affect their experience in their graduate STEM programs.

Implications for Research

Although current definitions define historical underrepresented minorities in STEM as African Americans, Hispanics/Latinos, and American Indians/Alaska Natives, this study raises questions about broadening that definition when conducting research studies to make it more inclusive. Many of the women who responded to the study invitation indicated that they were underrepresented minority students in their particular STEM disciplines despite the fact that they are not included within the groups traditionally considered as underrepresented. For example, a student from Taiwan reported that she felt that she was an underrepresented minority student in her program. Although she is considered "Asian" according to DMV's demographic classifications, which is not an underrepresented minority population in the STEM fields, she argued that because of hegemonic power differentials between Taiwan and China, she actually feels underrepresented and discriminated against. Jaschik's (2013) article, "The Deceptive Data on Asians," provides multiple examples, including discrepancies in students' SAT scores and educational

attainment data, that show the need for disaggregation of the various “subgroups” that are considered within the broader umbrella of the Asian-American category. Jaschik (2013) suggests that this aggregation to Asian may obscure differences and hide inequities in experience. In addition, Wu and Jing (2011) contend that even if Asian women are not underrepresented as students in STEM education programs, they are underrepresented in leadership positions in academia, government, and industry due to the glass ceilings that prohibit women’s advancement and a “bamboo ceiling” (Asian stereotyping) that discourages them from advancing professionally in STEM fields (para. 4). These arguments provide justification for more research to determine the range of definitions actually employed by people to describe themselves, and thus to understand better their educational experiences.

Additionally, three women graduate students from Middle Eastern backgrounds reported being the only Middle Eastern women in their programs. However, only one of the three women is a first-generation graduate student; for that reason, I included her in the study. Although, internationally, Middle Eastern/North African women are not underrepresented in studying STEM fields, they are underrepresented as working professionals in these fields (Kranov, DeBoer, & Abu-Lail, 2017). During the time of this study, conversations surrounding the upcoming 2020 Census included a debate about whether to create a minimum reporting category for the proposed combined race and ethnicity question format for people who self-identify as “Arabs and Middle Easterners” (Mancini, 2017, p. 12245). The discussion about whether to incorporate an additional MENA category as a distinct racial group from White initiated in the 1990s in response to the fact that White, based on the Office of Management and Budget’s 1997 federal

standards on race and ethnicity, includes all people “having origins in any of the original peoples of Europe, the Middle East or North Africa” (U.S. Census Bureau, n.d. p. 1). Advocates for a separate MENA category contend that disaggregation from the White category is necessary to achieve an accurate count of MENA populations in the United States (Arab American Institute, 2018). As a result of decades of public discussion, pressure from advocacy groups to disaggregate Middle Eastern/North African from the White category, and race and ethnicity research, the U.S. Census Bureau tested alternative versions of the race and ethnicity question, which included alternative question formats, instruction wording, question terminology, and response categories, one of which was a “Middle Eastern/North African” response category, on the 2015 National Content Test (Matthews et al., 2017, p. xi). Although the United States Office of Management and Budget has the authority to determine the standards for classification of federal data on race and ethnicity, in early 2018, the U.S. Census Bureau announced that it had to make a decision in order to deliver the 2020 Census question wording to Congress for approval and therefore would follow the current 1997 OMB standards by not having the Middle Eastern/North African category appear as its own response option on the 2020 Census (Fontenot, Jr., 2018). This debate, the argument of many advocacy groups that calls for the disaggregation of Middle Eastern/North African from the White response category, the rise in discrimination and hate crimes against Arab and other Middle Eastern groups in the United States since September 11, 2001, and the information that Alma shared in her *testimonio* about the challenges that she experienced provide justification for the inclusion of Middle Eastern/North African women as one of the underrepresented minority groups of women in STEM disciplines and, therefore, the inclusion of the participant in this study.

It is essential to both recognize and remedy all forms of inequality and injustice. As Dr. Martin Luther King, Jr. said, “injustice anywhere is a threat to justice everywhere.” However, it is also important to revisit the statements made by the women participants (Bianca and Elizabeth) who acknowledged that the challenges that visible and traditionally underrepresented minorities have experienced are of a greater magnitude than their own and, therefore, the support that those minorities receive should be greater due to the legacy of systemic and structural discrimination that they have experienced.

In her post, Griffin (2018) discusses ways that universities can simultaneously address problems in STEM culture and institutional climate to increase diversity in these fields. Griffin (2018) uses the term “minoritized” rather than underrepresented minority to describe students. She suggests that these terms have distinct connotations: minority signifies a smaller number whereas minoritized reflects power differentials. Griffin (2018) writes: “The term ‘minoritized’ acknowledges how social constructs like race, gender, ethnicity, religion, and sexual identity influence power dynamics and exposure to oppression” (para. 15). Smith (2016) explains the difference between minority and minoritized and argues that the term minoritized more accurately conveys the situation in which women and underrepresented students in STEM find themselves: the lack of power or representation is forced upon them by prevailing social constructs, which the verb (minoritized) highlights. Using this terminology, Smith (2016) further illustrates how people can be minoritized even if they are not numerical minorities. For example, although women constitute half of the population, they still hold less economic power than men, which the gender pay gap highlights. All of the women who participated in this study are certainly minoritized, and they also all self-identify using the terminology

underrepresented minorities to describe the marginalization that they experience in their STEM fields despite the fact that some of the women are neither visible minorities nor from historically underrepresented backgrounds.

Bianca and Elizabeth are aware that women who are visible minorities may face challenges greater than their own. Bianca mentions that she has seen white privilege in her department and attributes the difficulties that her classmate and peer mentor experiences to it. Bianca also recognizes instances in which she thinks that she may have benefited from what she calls her “white-passing privilege.” Although Bianca recognizes the importance of the perceptions of others, at the same time, she strongly defends her right to self-identify in a way that is meaningful to her and representative of her background and experiences; she contends: “it doesn’t make me less Latina that my appearance is not obvious of my ethnicity.” While Bianca self-identifies as an underrepresented minority (a Latina woman) in her STEM field, she also acknowledges that she has privileges that neither her family in Latin America nor her mother, who immigrated to the United States at a young age with limited English proficiency, have, and concedes that they may have encountered more obstacles in gaining access to and participating in education than she did.

Although Bianca does not use the term, she alludes to the concept of intersectionality and how it frames women’s experiences in STEM throughout her *testimonio*. Crenshaw (1989) introduced the concept of intersectionality as a way to describe the overlapping systems of oppression that affect women of color who are simultaneously oppressed because of their race and gender but often excluded from analyses of or activism for either type of injustice because the focus of each is on black

men or white women, respectively. Bianca is aware of times when she has experienced overlapping systems of oppression and when she is privileged as compared to her friends or family members.

Throughout her *testimonio*, Elizabeth also conveys her understanding of intersectionality. Elizabeth acknowledges that the marginalization that she experiences and the minority status to which she ascribes are specific to her participation in a STEM graduate degree program: she is a white woman from working class family who is the first in her family to attain a graduate degree. For Elizabeth, the intersectionality of discrimination that she experiences is related to her gender and social class; however, she is privileged because of her race. Crosley-Corcoran (2014) offers a similar interpretation of intersectionality in her blog post, *Explaining White Privilege to a Broke White Person*, in which she concedes to having privilege as a White person but also details the prejudice that she has encountered due to her social class. In her *testimonio*, Elizabeth conveys her awareness of her white privilege in stating that women who are also racial or ethnic minorities experience greater challenges both in their STEM programs and in broader society. From her own experience of being one of the only women at an academic conference, she ponders how a colleague at the conference who is a woman of color feels being not only one of the few women and one of the few scholars of color in attendance but also perhaps the only woman scholar of color at the conference.

Despite recognizing the privileges that she has, Elizabeth also suggests that she is an underrepresented minority woman in her STEM field. Her interpretation of the term underrepresented minority woman in STEM could be considered consistent with *U.S. Code* Title 20, Section 1067e-1(b)(3), which lists women as one of the underrepresented minority

populations in STEM and states that “groups currently underrepresented in STEM fields, includ[e] Latinos, African-Americans, and women” (20 U.S.C. § 1067e-1(b)(3), 2011). In addition, the definition of underrepresented for the federal government’s Equal Employment Opportunity Program includes women: the term underrepresented “is used to describe the extent to which women and minorities are represented in particular grade levels and job categories” within the federal government (National Archives, n.d.).

In addition to Elizabeth, Alma’s self-identification as an underrepresented minority Arab woman could also be considered consistent with *U.S. Code* Title 20, Section 1067k(2), which provides support for the application of this term to additional backgrounds with the last item in the list (“other ethnic group underrepresented in science and engineering”). This statement provides justification for arguing that the list is not exclusive and may not be comprehensive as written. For example, although the list of underrepresented ethnic backgrounds in STEM does not specifically include students from Middle Eastern or North African origins, the lack of a bounded or precise definition of the term underrepresented minority shows that an expansion of its application is possible.

Higher education institutions and scholars previously have expanded or advocated for the expansion of the definition of underrepresented minorities. For example, the University of California, San Francisco’s (UCSF) Office of Diversity and Outreach also lists students from “Filipino, Hmong, and Vietnamese only” backgrounds as underrepresented minorities (in addition to the students who self-identify as African American/Black, Hispanic/Latinx, Native American/Alaska Native, Native Hawaiian/Other Pacific Islander) as well as students of “two or more races, when one or more are from the preceding racial and ethnic categories in this list” (UCSF Office of

Diversity and Outreach). In addition, Baron (2011) suggests including “sexual minorities” along with racial and ethnic minorities as part of the populations considered underrepresented in American education institutions and professions. Baron (2011) argues that sexual minorities also experience social, structural, and systemic discrimination, but lack any similar legal recourse to the affirmative action policies that are available to racial and ethnic minorities.

All of the women participants in this study self-identify as underrepresented minorities and describe multiple and overlapping challenges that they have encountered during their graduate STEM degree programs and in accessing institutional support to help them to navigate these challenges. These women are both a numerical minority within and minoritized by their graduate STEM degree programs. Although this study uses the terminology with which the women describe themselves, some questions for further consideration arise regarding their universal application of the term underrepresented minority. For example, could broadening the application of this terminology have unintended but deleterious effects on traditionally underrepresented populations’ access to or participation in STEM higher education programs and careers? Could it cause dilution of support available to these populations?

Yes, is the short answer to the aforementioned questions. Although the concept of intersectionality provides a more nuanced way of understanding and addressing discrimination, current policies and laws that exist to redress social, structural, and systemic injustices do not approach existing inequities from this perspective. In her 2016 TedTalk, *The Urgency of Intersectionality*, Crenshaw (2016) explains how frames of social (in)justice often miss where “social dynamics come together to create challenges that are

quite unique.” Crenshaw (2016) provides an overview of how police violence against black women has gone unrecognized and argues that the law is both “partial and distorting” and has a “framing problem.” Because of these characteristics, the law often overlooks people: in the case of Crenshaw’s discussion, black women who are victims of police violence fall through the cracks between existing categories (race and gender) because race-based analyses focus on African American men and gender analyses focus on white women. Crenshaw (2016) advocates for the application of intersectionality to broaden the frame; however, she admits that its implementation could be difficult because the lens with which current laws and policies view these issues are myopic: they see gender and race as monolithic concepts and do not recognize overlapping or nuances in experiences. Although the women participants in this study acknowledge the different types of discrimination that they encounter, and as Bianca’s *testimonio* shows, recognize that differentiated levels of support are needed, current laws and policies do not.

Unlike some federal benefits (e.g., veteran’s disability benefits) for which the federal government distributes compensation based on a calculated need (e.g., disability status and both number and age of dependent children), laws and policies either provide underrepresented minority students with support resources or they do not. Providing all women with the same amount and type of support could reduce the resources available to people who need them more, and quantifying inequities and injustices that women experience in STEM and calculating support is not only impossible but also impractical. However, the application of intersectionality as a lens to examine this issue could help to find a more appropriate solution that provides differentiated support based on and in response to students’ distinct needs.

Although the women participants in this study recognize that the intersectionality of their demographic characteristics creates unique challenges and experiences for each of them and that they may be more or less privileged than other underrepresented minority women in STEM, they all self-identify as underrepresented minority women in STEM. The application of Taylor (1994) suggests both that people's self-identification is related to others' perceptions of them and that questioning these women's right to self-identify as minority women in their STEM programs constitutes oppression. Taylor (1994) explains that a person has the right to self-identify and that this self-identification is an agentic action. Therefore, limiting or delegitimizing a person's self-identification restricts her agency.

While the women participants acknowledge that there are differences in the magnitude of oppression that women can face in STEM fields, a better term does not exist to accurately describe the obstacles that they have experienced and continue to encounter. As Crenshaw (2016) contends: "Where there is no name for a problem, you can't see a problem, and when you can't see a problem, you pretty much can't solve it" (8:41). Despite the lack of meaningful alternative terminology to describe their experiences in their graduate STEM degree programs, the women's *testimonios* all suggest that each woman is one of the few women in her program and one of the few students from a diverse racial, ethnic, and/or socioeconomic background.

The small number of women from underrepresented minority populations in STEM programs and the women's perceptions about the lack of acceptance of diversity within DMV's institutional culture are especially problematic when considering statistics that suggest that DMV is one of the universities that awards the most minority undergraduate

and graduate degrees in STEM fields. In each of the women's five graduate programs (aerospace engineering, astronomy, computer science, electrical and computer engineering, and environmental chemistry) the *total* percentage of graduate students who identify as underrepresented minority students is less than 10 percent. This small percentage is even lower when it is disaggregated by gender. For example, statistics from the computer science department confirm Chelsea's suspicion that she is the only underrepresented minority woman in her graduate program. If the women in this study are experiencing the challenges that they describe in their *testimonios*, then what obstacles are visible or traditionally underrepresented minority women facing in gaining access to and participating in graduate STEM degree programs at DMV or at other universities that have even less diversity?

In addition to reexamining term "underrepresented minority," this study acknowledges the challenges that the first-generation women graduate student participants faced and raises a question about whether the terminology that defines who constitutes a first-generation graduate student is inclusive enough or accurate. Most of the literature suggests that first generation graduate students are students who, after being among the first in their families to receive an undergraduate degree, go onto graduate school; however, the terminology that defines who constitutes a first-generation college student is not consistent. Some studies indicate that students are first-generation college students when neither parent has ever attended college while other studies suggest that students are first-generation college students if they are the first in their family to graduate with a bachelor's degree; other studies use the definition first-generation college student when only one parent (usually mother) has not attained a bachelor's degree. Finally, other studies suggest

that a student is still considered a first-generation college student if their parents attended college but did not live with them (Toutkoushian et al., 2018).

Although multiple and at times contradictory definitions of who constitutes a first-generation college student exist, Toutkoushian et al. (2018) contend that no matter which definition is used for first-generation college students they are still at a disadvantage as compared to their non-first-generation counterparts. In providing evidence for Toutkoushian et al.'s (2018) claim, the women's narratives show how they, first-generation graduate students, still experience difficulties. The challenges that the women in this study experience highlight the fact that more nuanced terminology is needed to develop targeted institutional policies and practices that better address inequities between or among students.

Although universities should be responsive to students' needs and attempt to facilitate equity in educational experience, expanding the definition of first-generation students could exacerbate existing inequities and reduce the resources available for the students who need them the most. Furthermore, by grouping all first-generation students together, institutional policies and practices are unlikely to meet students' differentiated needs. The institutional support available to first-generation college students on DMV's campus is primarily targeted to undergraduate students, and as the women participants' *testimonios* highlight, does not respond to their needs as first-generation graduate students. For example, DMV University offers financial awards and academic support specific to first-generation college students pre-college and during their undergraduate degrees. Other student initiatives designed to respond to the needs of first-generation college students include a student organization for first-generation transfer students (Stoller, 2016).

Although these resources are both necessary and important, they do not provide support for first-generation graduate students' needs.

Recent events on DMV's campus offer hope that additional support may be forthcoming: on National First-Generation College Student Day (November 8, 2017), DMV University held an event to recognize all of "the first" accomplishments that students have had including being the first person in their families to study abroad or the first in their families to pursue a master's degree. While this recognition helps to encourage and motivate students, it does not address the need for differentiated support for students who are the first in their families to attend graduate school, which the women participants emphasize in their *testimonios*. Being first-generation graduate students, the women share that they are both numerical minorities in their graduate STEM programs and feel minoritized by their institutions due to the lack of support available to them. Furthermore, the absence of any alternative meaningful terminology to describe their situations, other than first-generation graduate students, combines them with first-generation college students, which increasingly blurs their experiences and disregards their needs.

Recognition of the diversity of first-generation students' identities is a positive first step toward responsive policymaking, which needs to investigate questions that arise from this study: if the five women participants who responded to this study invitation have one parent who completed an undergraduate degree, then are there any first-generation women college students (whose parents do not have an undergraduate education) in graduate STEM programs? And, if the women in this study are experiencing the challenges that they describe in their *testimonios*, then what obstacles are women who are first-generation college students encountering that prohibit their access to graduate STEM programs? The

answers to these questions are not only important for improving women students' experiences in graduate STEM programs but also for amplifying the diversity of students and addressing the inequities among them.

Conclusion

The *testimonios* from each of the five women in this study highlight the multiple challenges that they have experienced as women who are underrepresented in graduate STEM programs. Although some of the women are not traditionally underrepresented minorities and their minority status may not be visible to their peers or professors, the difficulties that they encounter are real and warrant redress. In addition, although these students have at least one parent who graduated from college, they still encountered obstacles both in gaining access to and in navigating through their graduate STEM programs due to a lack of institutional support targeted to their needs. Despite having difficulties, the women not only have persisted in their academic programs but also have demonstrated noteworthy success: one of the students was hired for a tenure track position at an ivy league university although she has not yet defended her dissertation. Another student has secured herself employment prior to her graduation at one of the top technology companies in the United States. In addition, one of the women participants is the recipient of an NSF grant, which she was awarded prior to even taking her qualifying exams.

The women attribute much of their success to their highly valuable assets of community cultural wealth. The women's *testimonios* offer detailed descriptions that illustrate how they capitalized on these assets to facilitate their access to and success in their highly technical STEM fields even at advanced levels of graduate school. The women described the ways in which their various assets of community cultural wealth provided

them with multiple methods of support: from emotional to moral to aspirational to logistical to a means of professional networking. The concrete support that the women shared in their *testimonios* serve as a counternarrative to the canon of literature that views underrepresented minority and first-generation college students through a deficit lens, and their *testimonios* expand on the existing literature by providing examples that show how community cultural wealth both exists within and is a strategic asset of multiple marginalized cultures.

Although their community cultural wealth offered tremendous support to the women, they note instances in which they sought supplementary institutional support to navigate challenges. Each of the women describe invaluable formal and informal support that they have received from their undergraduate and graduate institutions; however, they also highlighted ways in which the culture of their departments and, at times, DMV university at large, has not fulfilled the promises made in the rhetoric that not only welcomes but also encourages diversity and inclusion. A computer science professor and previous administrator's comments reinforce the women's feelings about institutional support for diversity and inclusion, which he termed as "lip service without genuine support." Although their graduate degree programs have been characterized by a struggle with this contradictory support, the underrepresented minority and first-generation women graduate students continue to overcome this challenge and succeed in their STEM fields due to their community cultural wealth. For example, Alma's familial capital supported her not only throughout her difficult relationship with her previous advisor but also during the time she did not have an advisor or funding. In addition, both Bianca and Daniela have used their navigational capital to develop agentic perspectives that they apply to manage

the stress of and effectively respond to the challenges that they encounter within their departments.

In discussing health care financing and social justice, Paul Farmer (2015), an American anthropologist, physician, and Harvard University professor, contends that “equity” is the only acceptable goal” (p.111). This goal is equally applicable to and important for education. However, the women participants’ continued quest for more and better institutional support suggests that this laudable goal has still not been achieved in all graduate STEM programs at DMV University. This study asks, “what does culture have to do with it?” The findings confirm that culture plays an important role in underrepresented minority and first-generation women graduate students’ experiences and success in their graduate STEM programs. Although the women describe the institutional culture of their graduate STEM programs (and, at times, DMV University at large) as comprised of contradictory support and a contributing factor to their turbulent journeys through graduate school, they share that their individual cultural assets (various forms of community cultural wealth) have been constant navigational beacons guiding them through the uncharted territories of their graduate degree programs and toward their success.

Appendix A: Student Interview Invitation Letter

Dear Graduate Students:

Hi! My name is Lauren DeCrosta, and I am a PhD candidate in the International Education Policy Program in the College of Education at the University of Maryland, College Park. I am reaching out to women graduate students in computer science, engineering, physics, and mathematics programs to participate in a qualitative study as a part of my doctoral dissertation entitled, “What’s culture got to do with it? An investigation into individual and institutional factors that support underrepresented minority and first-generation women graduate students in STEM fields.”

With this research, I seek to better understand the experiences of underrepresented minority and first-generation women graduate students in STEM fields, as well as explore the cultural assets and institutional factors have supported their success.

This study involves two individual interviews that will take place at a location convenient for each student. Each interview should no more than 45 minutes to complete. There will also be a one-hour focus group session in which we discuss common themes from the interviews.

The interviews will include questions such as: What is it about your academic major that encouraged you to pursue it? Is there anything particular from your cultural background from which you draw strength that has helped you to succeed in your academic program? Are there any university policies that have supported your success in your graduate program? All interview responses will be kept confidential, and all identifying information, such as names of people, programs, or places will not be published.

Participation in this study is completely voluntary and will provide you with an opportunity to share your perspectives and provide insight into women’s experiences in STEM graduate studies.

If interested in participating, please contact me.

Thank you kindly for your time and with best regards,

Lauren

Appendix B: Interview Guide No. 1: Student

I am researching the experiences of women who are underrepresented minority and first-generation college students in graduate STEM programs. I am particularly interested in learning about what individual and institutional factors affect students' experiences and support their success in STEM fields.

Please know that your name will not be included with your response, and I will protect your confidentiality by saving the transcript of our conversation with a pseudonym only. I have asked if I could tape record (and take notes about) our conversation. If you feel anything we discuss could personally identify you, please let me know.

1. Tell me about your program.
 - a. What is it about this academic major that encouraged you to study it?
2. Why did you want to go to graduate school?
 - a. Why did you choose this particular program/university?
3. What did you envision your graduate program would be like?
 - a. Classes?
 - b. Relationships/interactions with other students?
 - c. Relationships/interactions with faculty?
4. Has your experience been similar to how you envisioned it?
 - a. If yes, please provide some specific examples.
 - b. If not, please explain what was different.
5. Has your gender been important during your experience as a graduate student in your program? Has your race OR ethnicity been important during your experience in your graduate program? Please explain why or why not.
6. What other qualities or characteristics about you have been significant during your experience in your graduate program?
7. Is there any additional information that you would like to share that you think is relevant to your experience in a graduate STEM program?
8. Is there any question that you were waiting for or expecting me to ask that I did not that you think is important to understanding your experience in a graduate STEM programs?
9. Where should I send the transcript?

Thank you again for your time and for participating in this interview. I will forward you a copy of the transcript for you to review. I will also share with you the common themes that emerged from these interviews.

Appendix C: Interview Guide No. 2: Student

Following up to our previous conversation, I am investigating the experiences of women who are underrepresented minority and first-generation college students in a graduate STEM program. I would like to focus our discussion today on what individual and institutional factors support students' success in STEM fields.

Please remember your name will not be included with your response, and I will protect your confidentiality by saving the transcript of our conversation with a pseudonym only. I have asked if I could tape record (and take notes about) our conversation. If you feel anything we discuss could personally identify you, please let me know.

1. During our last conversation, we discussed some challenges you have encountered in your program including _____, _____, and _____ (challenges mentioned in first interview). Is there anything particular from your cultural background from which you draw strength that has helped you to succeed in your academic program?
 - a. In what ways has your cultural knowledge/traditions served as a source of strength or support to you when handling some of the challenges you have experienced in your academic program?
 - b. How have your unique family or cultural experiences helped you to navigate some of the challenges you have experienced in your academic program?
 - c. My parents used to always tell me, "When the going gets tough, the tough get going", or "Nobody said life would be easy; just worthwhile." Are there any particular cultural sayings that have been especially inspirational or motivational to you?
2. In what other ways has your family/cultural community supported you in completing your undergraduate degree and accessing graduate school?
 - a. Can you provide a particular example of a time in which your family/cultural community support was necessary to successfully handling a challenge in your undergraduate or graduate experience?
3. Many students talk about a dual culture: one at home and one at school. If this sounds familiar to you, can you describe your two cultures? If this does not sound familiar to you, can you explain why not?
 - a. How has your family/cultural community helped you balance your two cultures?
 - b. In what ways have professors in your department helped you to balance your two cultures?
 - c. Are there any events/programs in the university that have helped you to balance your two cultures?

4. Describe your image of a successful graduate student.
 - a. Do you perceive yourself as successful? Why or why not?
 - b. Do you think your family values or validates your success? If yes, explain how they show you. / If no, why not?
 - c. In what ways does the university value or validate your success? Provide some specific examples. / If no, why not.
5. Are there any university (program/department/college/campus) policies that have supported your success in your graduate program?
6. If you could give another [self-reported race/ethnicity, if noted in first interview] woman the guidance that you wish you had received to help you succeed in your graduate STEM program, what would you say/do?
7. Do you have any questions for me?
8. In preparing to set up a focus group session, what three days/times would be best for you to have a one-hour meeting (based on your usual schedule)?

Thank you again for your time and for participating in this interview. I will forward you a copy of the transcript for you to review. I will also share with you the common themes that emerged from these interviews.

Appendix D: Student Focus Group Guide

Thank you for agreeing to participate in this focus group session. As previously mentioned, we are going to discuss both your experience as an underrepresented minority and/or first-generation woman student in your STEM graduate field and the individual and institutional factors that support your success.

There are no right or wrong answers to the questions we will discuss in today's session. I would like to hear from everyone today because each of your experiences and opinions are unique. I hope all participants will provide honest responses even if they are different from what other participants have shared.

Although the focus group session will be tape recorded, your responses to the questions will be kept anonymous, and personally identifying information will not be documented. Please remember that your participation in this focus group is completely voluntary, and participants are asked to respect the confidentiality of each other.

1. What is the best part of your experience in your program?
2. What is the worst part of your experience in your program?
3. What in particular do you notice is different about your own experience from the rest of your classmates?
4. What, if anything, do you notice is different about your experience in your program from other women graduate students who are not in a STEM major?
 - a. Most of you mentioned the lack of racial and ethnic diversity in your programs. How has that affected your experience?
 - b. Most of you mentioned the lack of gender diversity in your programs. How has that affected your experience?
5. In the interviews, respondents noted _____ and _____ (two most common themes derived from Interview No. 2, Question No. 2) as supports from their cultural background that have helped them succeed. Why do you think _____ and _____ are such strong supports?
 - a. If _____ or _____ has not been a particularly strong support for you, what else from your cultural background has been a strong support?
6. Respondents also said _____ (most common theme from Interview No. 2, Question No. 3) helped to support their success. Why do think _____ is important to helping women who are underrepresented minority and/or first-generation graduate students in STEM fields succeed in a graduate program?

- a. Other than _____ what else do you think is important to your success?
7. In the interviews, respondents noted _____ two most common themes derived from Interview No. 2, Question No. 4) as the strongest university supports to their success. Why do you think _____ and _____ are such strong supports?
- a. If _____ has not been a particularly strong support for you, what would you have been a strong support?
 - b. If there have not been any strong institutional supports, what could be a support to you?
8. How do you feel about yourself when you're doing well in your coursework?
When you're not?
- a. All of you mentioned imposter syndrome as a challenge that you have experienced. What resources has the university offered you in handling this? If none, what resources would have been helpful?
9. Is there anything else you would like to add about your experience in your program?

Appendix E: Faculty Program Administrator Interview Invitation Letter

Dear Professors:

I am a PhD candidate in the International Education Policy Program in the College of Education at the University of Maryland, College Park. As part of my qualitative doctoral dissertation study, “What’s culture got to do with it? An investigation into individual and institutional factors that support underrepresented minority and first-generation women graduate students in STEM fields”, I am looking for faculty who also serve in an administrative capacity in graduate STEM programs who would be interested in participating in an individual interview to discuss the experiences of underrepresented minority and first-generation women graduate students in STEM fields.

This individual interview will take place at a location convenient for each professor. The interview should no more than 45 minutes to complete.

The interview will include questions such as: What challenges do you think women face in STEM programs? What opportunities do you think women have in STEM programs? In what ways do you think the university supports students’ academic success? Is there anything particular from students’ cultural backgrounds that you have seen serve as a source of strength for students in their programs?

Participation in this study is completely voluntary. All interview responses will be kept confidential, and all identifying information, such as names of people, programs, or places will not be published.

If interested in participating, please contact me.

Thank you kindly for your time and with best regards,

Lauren

Appendix F: Faculty Program Director Interview Guide:

As we have discussed, I am interested in investigating the experiences of underrepresented minority and/or first-generation women graduate students in STEM disciplines. I am particularly interested in learning about the individual and institutional factors that affect students' experience and support their success in STEM fields.

Please remember your name will not be recorded with your response, and I will protect your confidentiality by saving the transcript of our conversation with a pseudonym only. I have asked if I could tape record (and take notes about) our conversation. If you feel anything we discuss could identify you personally, please let me know.

1. Tell me about your department/program.
 - a. What characteristics describe students in your department/program? (race, gender, socioeconomic factors?)
2. What challenges do you think women face in your department's STEM program(s)?
 - a. Academically?
 - b. Socially?
 - c. Do you think these challenges vary by program/discipline? Explain why or why not.
 - d. Do you think social or economic factors play a role (e.g., race/ethnicity or first-generation status)? Explain why or why not.
3. You mentioned [list challenges mentioned in responses to previous question] as challenges that women students face in your program(s). What supports does your department offer to students to assist them in successfully navigating these challenges?
 - a. How are they advertised to students?
 - b. How do students access them? (through an application process, through request process, through professors)
 - c. To what extent do students take advantage of them?
4. Describe your image of a successful graduate student in your department.
 - a. Do you feel the university values or validates students' success? Provide some specific examples. / If no, why not?
 - b. Do you think this validation varies by college/department/program?
 - c. Do you think this validation varies by sex?
 - d. Race or ethnicity?
 - e. Socioeconomic factors (e.g., first generation status)?
5. All of the women graduate student participants in my study mentioned having questioned either their ability to be successful in the program or the merit of their

own success. How do you think that affects their performance in the program?

- a. How do you think that affects their future career trajectory?
 - b. Does the program/department offer any support for students who feel this way?
6. Many times, individuals draw upon family or cultural knowledge, experiences or traditions for support. Is there anything particular from students' cultural backgrounds that you have seen serve as a source of for students in their programs?
 - a. Have you as a director tried to incorporate any of these familial or cultural supports into your department/program?
 7. Are there any institutional (program/department/college/campus) policies or practices that you think support underrepresented minority or first-generation women students' success in STEM graduate programs?
 8. Are there any specific practices that you think are effective in the classroom/on campus for supporting underrepresented minority or first-generation women graduate students' success in STEM programs?
 9. Is there any additional information that you would like to share that you think is relevant to understanding underrepresented minority women or first-generation women graduate students' success in your department's graduate STEM program(s)?
 10. Do you have any questions for me?

Thank you again for your time and for participating in this interview. I will forward you a copy of the transcript to review.

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